NOVEMBER 13, 1961

American Machinist / Metalworking Manufacturing

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Assembling aluminum car for coal mine from aluminum plate and extrusions—see page 1

- **Chemical milling of stainless in production,** page 109
- **Spark forming goes to work,** page 126

THE NEW "A" BORE-MATICS

Completely new machine design from base to bridges for versatility, capacity and ease of maintenance.

by Albert A. Arbogast

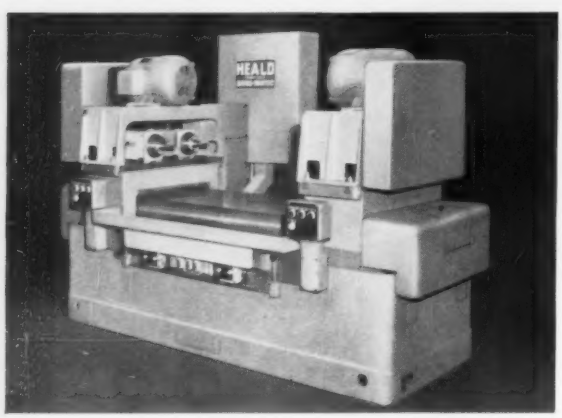
Manager, Bore-Matic Machine Division
The Heald Machine Company

What is the basic philosophy behind the new "A" series line of Bore-Matics? That's a good question—and a simple one to answer because the basic motivating factor was "simplicity" itself. For in almost every case the basic new design feature in this new Bore-Matic line makes them *easier* to set up, *easier* to change over, *easier* to operate and *easier* on service inspection. All this has been accomplished while still maintaining our continual trend toward higher standards of accuracy and precision.

Take the new machine bridges, for example. Within a given size of machine, bridges are removable and interchangeable. Furthermore if a user has a single-end version of a new "A" Bore-Matic he can readily convert it to a double-end unit by adding a second bridge, boringheads, drive, and associated cycle and hydraulic equipment.

Bridge pads and tee slots are provided at both ends of all machines in each of three size ranges. Bridge setback is infinitely adjustable within its range, too—permitting wider latitude for tooling and fixture design and minimum rapid traverse time. New bridge location has also substantially increased the workholding capacity of these standard machines.

Manifold hydraulic transfer plates and valves that used to be inside the base cavity are now mounted externally on a separate panel at the rear where they are more easily accessible—such a location also isolates a heat source from the machine base contributing to uniform precision throughout longest production runs.



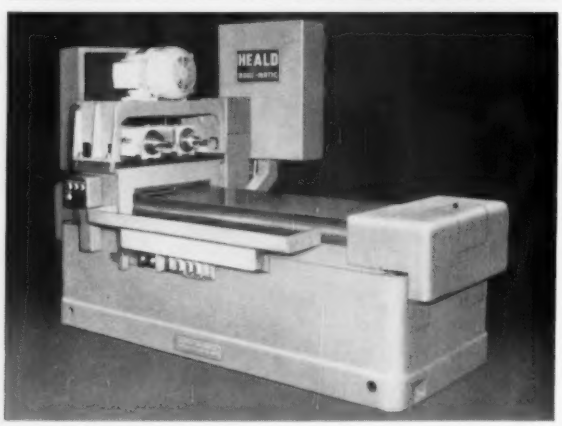
The hydraulic power unit has also been located separately from the base at the rear of the machine, for ease of access and elimination of thermal distortion.

The machine table is larger, heavier and travels on hardened and ground box type ways with hold downs—such construction assures maximum accuracy of table travel.

The new model Bore-Matics are now available in three basic "A" machine sizes—2, 3 & 4—each of which can be furnished as either single or double end machines.

Capacities of the new "A" series Bore-Matics are shown in the following table:

	222A	322A	422A
Width of Bridge	31"	34"	38"
Distance between Bridges (adj.)	16"-36"	24"-43"	30"-54"
Table travel	15" or 18"	20"	25"
Table Pad Dimension	14" x 55"	18" x 64"	24" x 80"



Above, Model 424A, single end version of the size 4 type Bore-Matic; bridge, heads, drive equipment, etc. on left end only.

At left, 422A, double end version of the size 4 type Bore-Matic; bridges, heads, drive equipment, etc. on both ends of machine.

It Pays to come to Heald

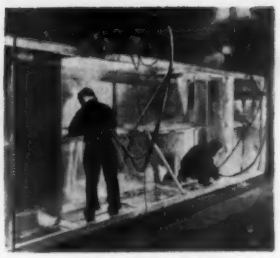
THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

CIRCLE 251 READER SERVICE CARD

COVER:

Welding one of 125 coal-mine cars being built of Alcoa plate and extrusion by Irwin-Sensenich Co.



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TURN PAGE FOR METALWORKING REPORT ——→

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

FORMING . . . Ultrasonic vibrations can be applied to a press ram to give over 25 times the static force applied. In addition, the vibrations **eliminate the need for heat in many hot-pressing operations, such as dimpling.** Details on this new type of high-energy forming will be disclosed in an early issue.

INSPECTION . . . Radar interferometers—that use split electronic waves in the same way a light-wave interferometer uses split light rays—**are being teamed with servo controls to provide automatic machine control and gaging for vertical grinders** working on non-conducting (dielectric) materials. **Development grew out of problems in measuring thickness of radomes and nose cones.** Three companies are involved: Holman-Paisley Associates (Seattle) builds the interferometer and Minneapolis-Honeywell builds the servo controls; together these control a Springfield Machine Tool Co vertical grinder.

FINISHING . . . Steel wool makes a good fine-finishing abrasive for tumbling when it is combined with a resin binder and formed into shapes. The abrasive shapes, which weigh only 55 lb/cu ft, are made by Antro Abrasives (NY, NY) and **will remove burrs as small as 0.002 in. from delicate machined parts** without measurable stock removal. And, depending on work material, steel wool **gives a fine satin finish without altering the original color.** Tumbling is done dry for most efficient results.

CUTTING . . . The largest single source of error in a typical lathe comes from crooked slides, according to studies by the University of California's Lawrence Radiation Laboratory. These studies, which allow reworking of standard tracer lathes to improve accuracies from 0.004 to 0.0003, show that a **20-microinch out-of-straightness can give a tool error of 1000 microinches.** This can be minimized by placing the templet carrier at spindle axis level, and as close to the spindle as practicable, LRL reports.

ASSEMBLY . . . Dial-type assembly machines with self-contained "put and take" devices are on the way from Robodyne Div, US Industries. The machines will use the Transfer-Robot 200 (AM/MM—Jul 24 '61, p121) as the work-placing devices. Normally supplied by bowl feeders, these **robots put parts into assembly fixtures on a rotating dial.** Low price ($2500) of the robots should open new possibilities for automatic assembly operations.

MANUFACTURING CONTROL . . . Thumbnail-size solar cells are now generating impulses in computers. Similar to the devices that transform light into electrical energy in spacecraft, the cells **supply power for reading punched cards** in the new Burroughs B200 Series computers. When a card passes between rows of lamps and cells, light passes through the punched holes, generating voltage and current. Thus the solar cells, which **eliminate the need for auxiliary generators,** make for more compact computer design.

CUTTING . . . Tool life is often more than doubled if, during sharpening, **ultrasonic vibrations are applied to the tool.** Russian tests using ultrasonic frequencies of low amplitude (0.003 to 0.059 in.) verified these results for R18 tool steel and VK8 carbide tips. One might expect even better results, since **coolant was not used in testing the ultrasonically sharpened cutters.** Key to the results seems to be surface texture, which was more than twice as smooth when tools were "treated" with ultrasonics.

WELDING . . . Hot machining can follow immediately after a joint is made by friction welding, according to a paper presented at the Metal Show in Detroit by M B Hollander of American Machine & Foundry Co. Normally, the machining would remove flash, of course, but **other cutting could also be done at the same time** if desired.

FORMING . . . Zircon refractories can be bonded with pure carbon, not resins, by a molding process invented by Bryant W Crocker of Watertown Arsenal (Watertown, Mass). Because there is no burn-off at pouring and molds do not react with molten metal, such metals as **titanium, uranium, steel, aluminum, and bronze can be cast.** In the process, shell or solid **mold halves are formed conventionally, heated to 1650 F under high vacuum, fastened together, then poured.** After patenting, licenses will be available for a nominal fee.

FINISHING . . . A power-operated painting machine that climbs up and down steel walls, as well as moves horizontally, has been developed by Esso Research & Development Co (Bayway, NJ). **Magnets in the machine's treads make it "stick" to surfaces** such as large storage tanks, or a ship's hull. An **air turbine drives the treads at about six inches per second** while an operator directs movement with pneumatic controls. Paint, applied by a roller attached to the machine, is fed through a pressure hose.

CLEANING . . . Heavy buffing compounds are easier to remove with a new material called V-240 by Enthone Inc (New Haven, Conn). When mixed with water to form a 5-10% solution and heated to operating temperature (180 to 200 F), it **forms a water-in-oil emulsion.** In this condition it rapidly penetrates the most tenacious soils because these are **acted upon by 100% hot solvent.** When work is removed from bath, the residual emulsion reverts to an oil-in-water condition (on the surface) and is easily rinsed off.

MATERIALS . . . New process for pressing and sintering copper supposedly costs 10% less than extruding or forging, according to Electrical Contacts and Specialties Div, Fansteel Metallurgical Corp. Electrical **conductivity of the sintered copper is 93% that of wrought,** hardness is Rh 80F compared to Rh 87F, tensile strength of 39,000 psi lies between 33,000 for soft wrought and 45,000 for hard wrought.

Continued on next page

Coming in AM/MM

- *Why we lack craftsmen today*
- *Ultrasonic forming*
- *How to work Mo-0.5% Ti*

METALWORKING REPORT ...

RELIABILITY . . . To the machine tool builder, reliability is a contractural obligation, says Leo P Gajda (Snyder Corp). It means the ability of a machine to produce accurate parts at 70 to 80% peak efficiency for one year without component failures. Another comment at the National Conference on Industrial Hydraulics, Chicago, was made by Liviu J Burza (Ford Motor Co). He says to **forget mathematical terms such as "mean time between failures,"** and define a machine's **reliability as a dollars-and-cents figure**—based on cost, performance, downtime, repair costs, and the like—that determines overall efficiency.

MATERIALS . . . A tungsten carbide with unsupported compressive strength consistently above 850,000 psi is being produced by Kennametal, Inc (Latrobe, Pa). Demand came from diamond and borazon synthesizers who need materials for dies, anvils, and backup plates in equipment that generates pressures up to 1,000,000 psi. The higher strength of the new carbides is said to be a **result of better quality control in processing.**

FORMING . . . Bending tests on Mo-0.5% Ti, one of the newer refractory alloys, **show a successful forming zone at an R/T ratio of five** (bend radius/thickness=5), but only with a forming temperature of 300 F. **Room temperature forming proved unsuccessful,** despite conventional formability tests that showed equal formability at 300 F and room temperature. Details of Boeing's work of Mo-0.5% Ti will appear in a future issue.

MANUFACTURING CONTROL . . . Automatic production reporting—from machine to data-processing equipment—is available with the Readout-Telecontrol system. To the basic Telecontrol system (introduced four years ago) a readout device has been added. Production data, transmitted by sensing devices to a central control panel, is **automatically recorded on punched cards,** which then can be fed into the plant's DP equipment.

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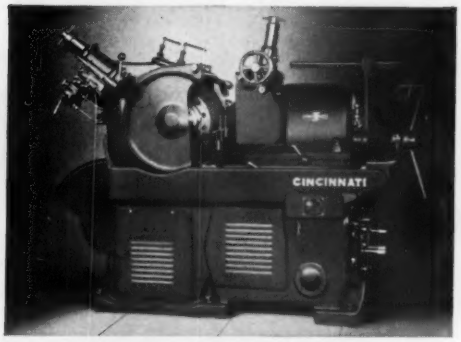
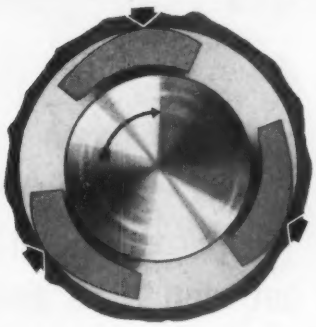
Everything about this machine



is obsolete except



its Filmatic Grinding Wheel Spindle Bearings

Filmatic bearings contradict just about everything we know about bearings and progress.

In the 23 years since we started building Filmatic-equipped centerless grinding machines, major advancements have been made in every component (refer to next two pages). But we haven't been able to improve on the Filmatic bearings. Nor has anyone else.

Altogether, Cincinnati has built about 28,000 various types of grinding machines using these bearings. We can identify only 32 cases of failure. This is reliability of 99.9 per cent!

Filmatic bearings never need adjustment once they leave the factory. They perform equally well for rough or finish grinding. There is absolutely no wear.

There are two Filmatic bearing assemblies around the grinding wheel spindle, completely submerged in oil. Each assembly consists of shoes or segments which can rock slightly. Rotation of the spindle draws oil between the segments and spindle, forming a high pressure wedge-shaped oil film between each shoe and the spindle.

These high-pressure oil wedges lock the spindle on the one center of rotation regardless of direction or force of load. This constant center of rotation not only assures precision grinding results, but also makes possible heavier cuts, rapid metal removal, and quick "spark-out" during the grinding operation.

For a graphic presentation of the amazing Filmatic bearing, ask for Publication No. G-604. Grinding Machine Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

CINCINNATI PRECISION GRINDING MACHINES:

CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

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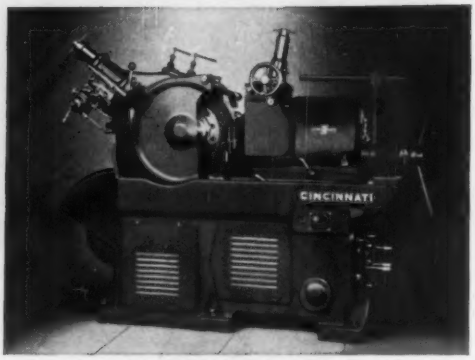
GRINDING MACHINE DIVISION



NOTICE

to owners of thousands of CINCINNATI Centerless Grinding Machines built between 1935 and 1945:

Almost everything about your old CINCINNATI Centerless Grinder is obsolete! If you've done a good job of maintenance, it may be just as good as the day you bought it. But that's no longer good enough!

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ELECTRO-HYDRAULIC INFEED. Feed rate and spark-out time are precisely the same for each part. Feed is against a positive stop rather than depending upon screw accuracy. Gives you consistent accuracy over the life of the machine.

OPERATOR EFFICIENCY. All working areas have been freed of obstructions. Controls are centralized (convenient rear handwheel control available). Extra steps, wasted time, awkward operator position—all have been eliminated to permit operators to produce more with less effort.

CINCINNATI

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • ROLL •

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220-8 Centerless Grinding Machine.
Ask for Publication No. G-727-2-D.

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EXCEPTION. One feature of your old CINCINNATI Centerless is *not* obsolete—the Filmatic grinding wheel spindle bearings. This is the only feature on which we've not been able to improve. These bearings require neither adjustment nor maintenance, they are highly accurate and apparently last forever. After 23 years, we've repaired only 0.1% of the many thousands in use!

If you care about costs and competition, you'll call in your Cincinnati representative right away. Ask him about the special trade-in proposition we're offering to make it easy to replace those old CINCINNATI Centerless Grinding Machines.

Remember, everything about your old CINCINNATI Centerless is obsolete. Everything, that is, except its Filmatic bearings and its great reputation.

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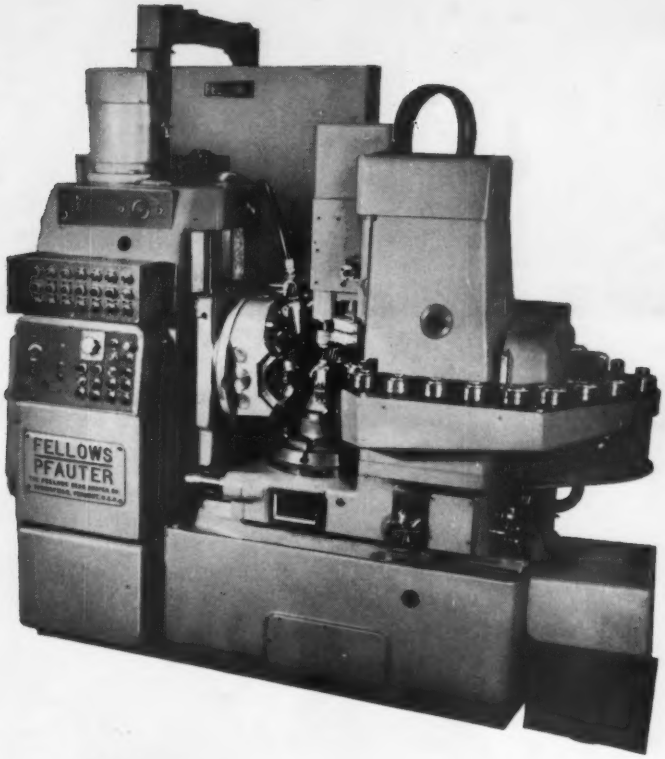
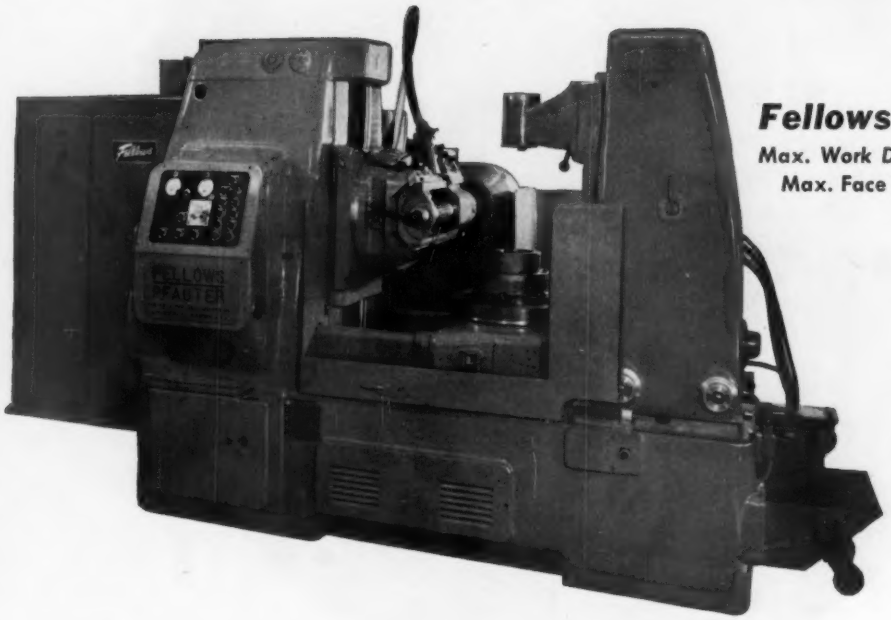


Fellows-Pfauter P400

Max. Work Dia. — 16″; Max. D.P. — 4;
Max. Face Width — 11″ at 16″ dia.;
Hob R.P.M. — 80-500.



Fellows-Pfauter P630

Max. Work Dia. — 25″; Max. D.P. — 3;
Max. Face Width — 16¼″ at 25″ dia.;
Hob R.P.M. — 62-390.

THE FELLOWS GEAR SHAPER COMPANY
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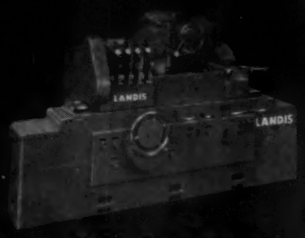
THE PRECISION LINE

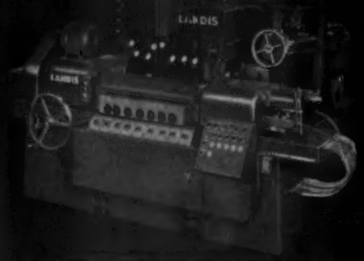
Fellows

Gear Production Equipment

Automatic Race grinder

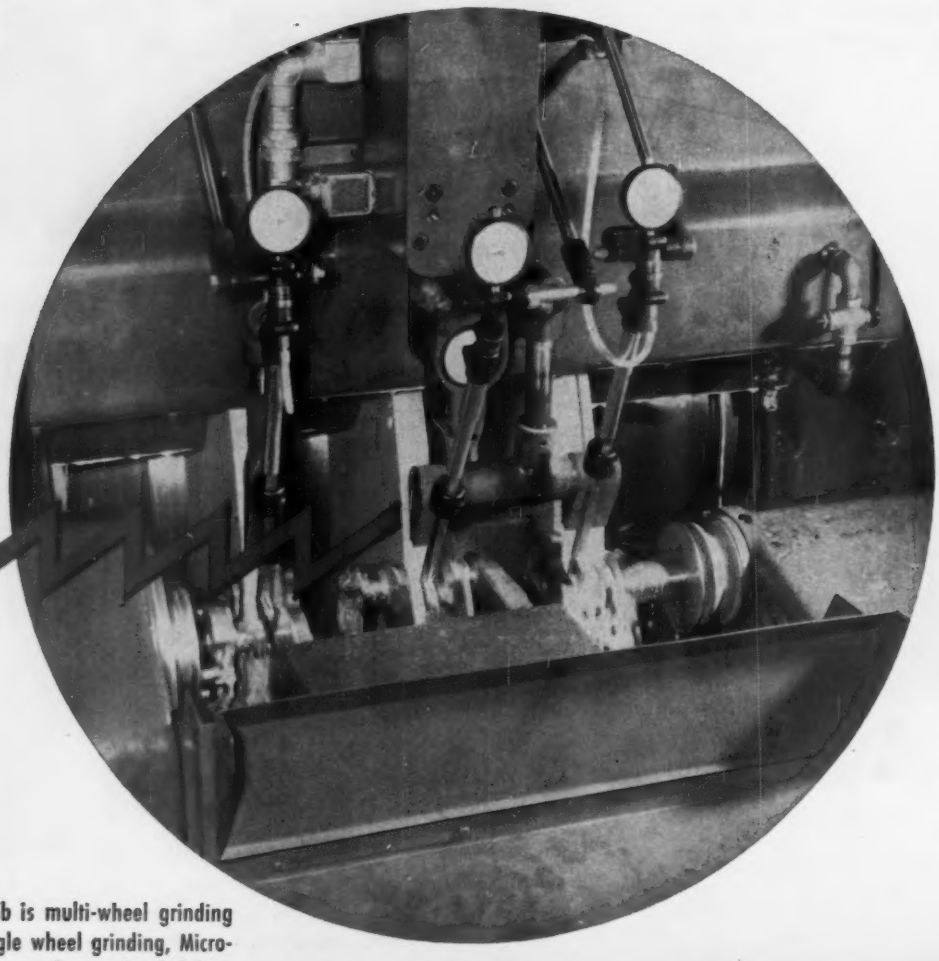


10″ R Plain grinder



14″ IWR Multiple Wheel grinder

Landis production grinders with Microfeed®



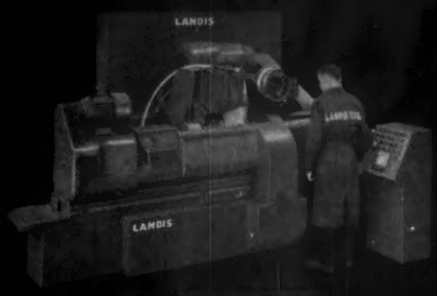
Whether your job is multi-wheel grinding like this, or single wheel grinding, Microfeed will assure quality and reliability.

typical Microfeed applications

tapered bearing race
specified size tolerance: .0002″

multiple diameter shaft
specified size tolerances: .0001″

Automatic Plunge grinder



Automatic Crankpin grinder

deliver closer tolerances consistently

Microfeed

- a new Landis precision wheelfeed that is a major breakthru in size control
- specified on new Landis grinders, Microfeed assures cylindrical grinding precision to your specified tolerances on a production basis
- automatically cancels all variables affecting work size

LANDIS

LANDIS TOOL COMPANY, WAYNESBORO, PA.

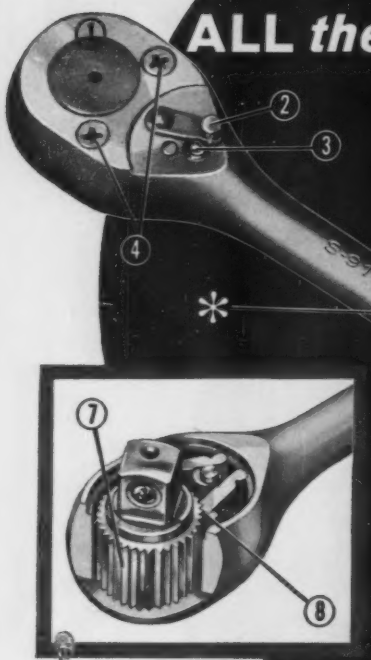
crankshaft line bearings
specified size tolerances: .0005"

steering knuckle
specified size tolerance: .0006"

crankshaft pins
specified size tolerances: .0005"

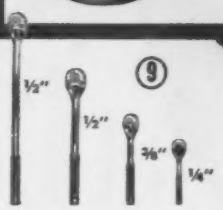
New ARMSTRONG "90" SERIES RATCHET

The ONLY *Ratchet with* ALL *these important features!*



1. Slenderized head
2. Thumb-operated reversing lever specially designed so it won't come off
3. Reversing-lever stop (Ball-and-spring prevents accidental shifting)
4. Simple to clean—only tool required is a Phillips screwdriver (wearable parts may be individually replaced)
5. Thin handle with knurled grip

6. Hole in handle for convenient hanging
7. Fine-toothed gear
8. Easy ratcheting action
9. ¼", ⅜", and ½" square drives (two handle lengths in ½" drive)

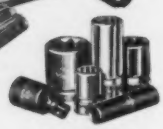


All wearable parts of ARMSTRONG Ratchets can be replaced individually, inexpensively, and easily. Entire ratchet handles need not be replaced in the event of tooth wear, as is necessary with ratchets in which the teeth are formed in the head of the handle.

* The name ARMSTRONG on these fine tools is your assurance of highest quality. Manufactured under strict quality control, all ARMSTRONG Tools can be used with confidence.

Extra heavy duty "50" Series ARMSTRONG ratchets (illustrated at right) are manufactured in 1", ¾", ½", and ⅜" square drive sizes. For complete information on these, as well as the approximately 5500 other tools in the ARMSTRONG Line, see General Catalog #700. Your local ARMSTRONG Distributor can supply you with Catalog #700 and can show you the new "90" Series Ratchets. If you do not know who handles the ARMSTRONG Line in your area, we will be glad to furnish this information upon your request.

EXTRA HEAVY DUTY RATCHETS



SOCKETS

WRENCHES

WRENCH SETS

Buy ARMSTRONG TOOLS from your Industrial Distributor

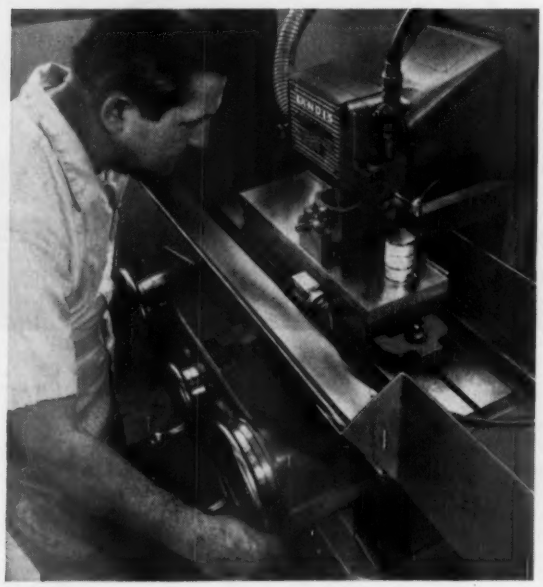
ARMSTRONG BROS. TOOL CO.

5215 W. ARMSTRONG AVE. • CHICAGO 46, ILLINOIS

Landis Abrasive No. 618 surface grinders at Speedring Corporation, Warren, Michigan

Speedring reports surface grinding missile components to 15 millionths using electronic gauging

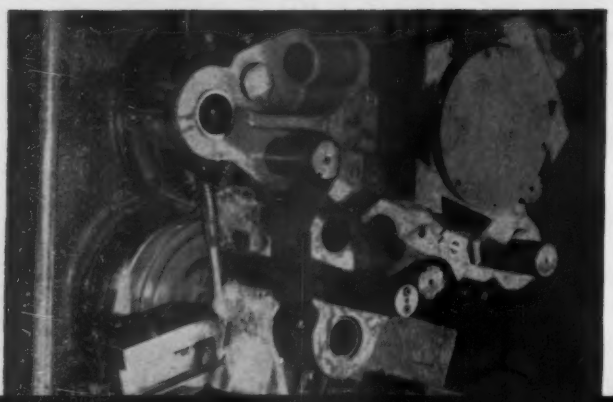
Finish grinding missile components on a Landis Abrasive No. 618 shown with electronic gauge and master block for checking height.



Landis Abrasive No. 618 surface grinders are top choice at Speedring for grinding missile components and gyro parts. They report that the table and spindle accuracies required to grind pure beryllium, beryllium oxides, ceramics, ferrites and many other exotic metals in their plant are rigidly controlled on these Landis Abrasive surface grinders.

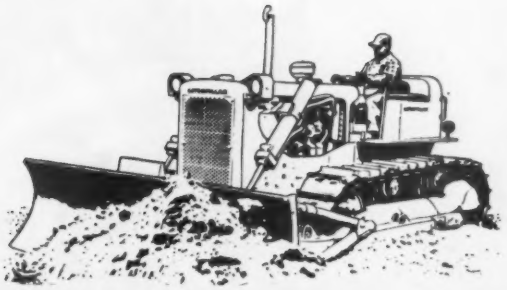
LANDIS
ABRASIVE

Landis Tool Company, Waynesboro, Penna.



Caterpillar takes advantage of "AC" versatility and ease of tooling by handling the wide variety of work principally with standard tools. Tool costs and tooling inventory have been sharply reduced. The ability of "AC's" to use combined and multiple cutting techniques in unusual ways, and to hold close tolerances, taper-free bores and fine surface finishes provided further cost-savings by reducing subsequent operations.

AT CATERPILLAR TRACTOR CO.
Davenport, Iowa



Six "AC" chuckers automate "service parts" production in lots down to 50 pieces

Unique construction of W & S Single Spindle Chucking Automatics permits boring taper-free holes to .001″ tolerances, eliminates machine alignment and operator problems experienced with old turret lathes.

"AC's" gave Caterpillar the quality control they were looking for. Tolerances of .001″ are held without constant operator attention. Because of an "AC's" unique construction—spindle and turret mounted in the main column casting—machine alignment problems have been eliminated, assuring consistent taper-free boring.

Caterpillar's Davenport plant produces repair parts for non-current tractors. It's a typical jobbing operation—lot sizes usually run 50 to 150 pieces, with plenty of variety and little repeat work.

Older hand turret lathes had raised direct labor costs out of proportion. Operators needed extra time and skill to hold work within tolerances, while taper-free boring demanded frequent alignment checks. Even so, scrap losses were high. On top of these problems, Caterpillar wanted to eliminate some second chuckings and precision finishing operations.

With the installation of 2AC and 3AC Chucking Automatics, Caterpillar's problems went out the door with the older machines. Today, rejects are almost non-existent. Tolerances of .001″ are easily held, and many second operations have been eliminated. *Each "AC" averages 50% more pieces on the floor per day, with one operator handling two machines including setup.* And setup time to the first good piece takes ⅓ to ½ less time than on the hand machines—mainly because the older turret lathes required extra time to get the first piece within tolerance.

If you're faced with problems like these, Warner & Swasey can help you properly solve them. Call the nearest Field Engineer or The Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD

ALMOST EVERY DAY
A NEW FLAG FLIES AT...

fair street

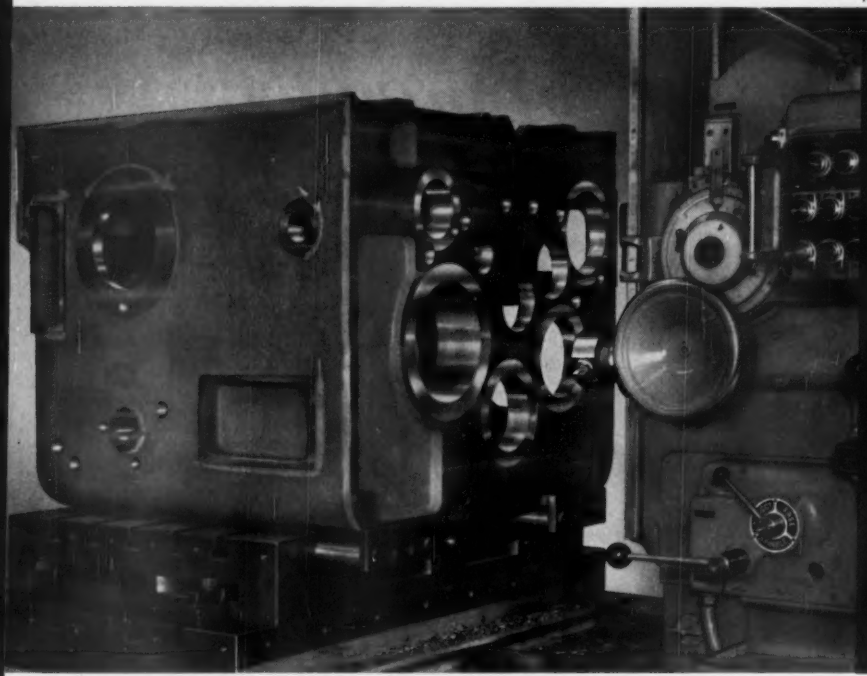
DE VLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

Every few days, someone from another country visits Fair Street. He may come from Asia, Australia, Canada, Europe, Latin America; any part of the Free World. And when he arrives, we display his country's flag in our lobby.

WHY DO THEY COME . . . these important industrial leaders from all over the world? They come because they are interested in finding better ways of doing things. These men must find solutions to problems raised by the need for increased accuracy

SOME OF OUR OVERSEAS USERS

A. B. Bofors—Bofors
Alfa Romeo—Milano
Alfred Herbert Ltd.—Coventry
Ateliers de Constructions Electriques de Charleroi—Charleroi
Ateliers G.S.P.—Chateaudun
Automobiles Peugeot—Buenos Aires
Brdr. Gram—Vojens
Bristol Aeroplane Co. Ltd.—Filton, Bristol
Brunner Corporation (Canada) Ltd.—Port Hope, Ontario
Canadair Ltd.—Laurent, Montreal, P.Q.
Daimler-Benz Aktiengesellschaft—Stuttgart
Ets. R. Messian—Cambrai, Nord
Fabrique Nationale d'Armec de Guerre—Liege
FIAT Sezione Automobili—Torino
Gebr. Heller Maschinenfabrik GmbH—Nuertingen
G. M. Holden's Limited—Melbourne
Hispano Suiza Ltd.—Geneva
Hitachi Ltd.—Kawasaki
Holland Signaal App. Fabriek—Hengelo
Innocenti—Milano
International Harvester Co. of Australia Pty. Ltd.—Geelong, Victoria
Kirloskar Oil Engines Ltd.—Poona
KLM Royal Dutch Airlines—Holland



WHAT YOU'LL SEE WHEN YOU COME TO FAIR STREET

- DeVlieg JIGMILS with Standard Controls, Diatrol and Tapac
- The Micropoint Tool Grinder
- The Microbore System of Precision Tooling

Lathe headstock rough and finish milled and bored from four sides in one setup on a 3B-48 JIGMIL. Total machining time is approximately 8 hours.

and higher productivity with readily available skills. Specifically, in the field of boring and milling, they've heard that the JIGMIL Technique and the DeVlieg concept of Precision Machining go a long way towards solving such problems. No one is ever disappointed. Every visitor, whether from overseas or local firms, is introduced to rewarding new concepts in machining. Concepts that once discovered, cannot be ignored.

K. Martin Maschinenfabrik—Offenburg-Baden
Kobe Steel Works—Kobe
Lidkopings Mek. Verkstads A.B.—Lidkoping
Maquinas Agricolas Romi S.A.—Sao Paulo
Mitsubishi Heavy Industries—Nagoya
Praga Tools Corp. Ltd.—Secunderabad
Regie Nationale des Usines Renault—Billancourt
R. Hoe & Co. Ltd.—London
Rolls Royce Ltd.—Derby
Sud-Aviation—Bouguenais
Sulzer Brothers Ltd.—Winterthur
Svenska Flygmotor A-B—Trollhattan
Toyota Motor Co.—Toyota
Vald. Henriksen—Copenhagen
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Vickers Ruwolt Pty. Ltd.—Melbourne
Volkswagenwerk GmbH—Wolfsburg
Von Roll Iron Works Ltd.—Klus
York Gears, Ltd.—Toronto, Ontario

WILL YOU BE THE NEXT TO VISIT FAIR STREET

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

Time is the measure of productivity

Time is the measure of productivity
Time is the measure of productivity

Time is the measure of productivity
Time is the measure of productivity
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Time is the measure of productivity

Time is the measure of productivity

Reduce grinding time and you increase productivity. Norton's many time saving innovations in varied stages of grinding production can reduce your grinding time up to 30%! The story is a profitable one. Here's why —

Norton Grinding Machines are engineered to permit higher wheel speeds to reduce cutting time. Norton's *Automatic Wheel Balancer* balances the wheel in *five seconds— on the machine.* You reduce time spent "grinding air" up to 85% because of Norton's *Automatic Wheel Contact Accelerator* which speeds the wheel to the work and compensates for work piece-diameter variation. Another advance is Norton's *Automatic Truing* which eliminates work interruptions and the *Automatic Wheel Wear Compensator* that stabilizes the grinding cycle.

Norton Grinders further add to your productivity by minimizing work spoilage with *Automatic In-Process Gaging.* In the case of surface grinders Norton *Higher Table Speed of 150 fpm* actually reduces grinding time up to 50%.

These are only some of the many reasons you can increase your productivity with Norton Grinders. They also offer accessories that literally transfer skills to machines — *ultra-fine feed,* and *automatic features* such as *steady resting, endwise locating, loading, constant peripheral wheel speed* and *hydraulically-operated feed screws* provide this competitive advantage.

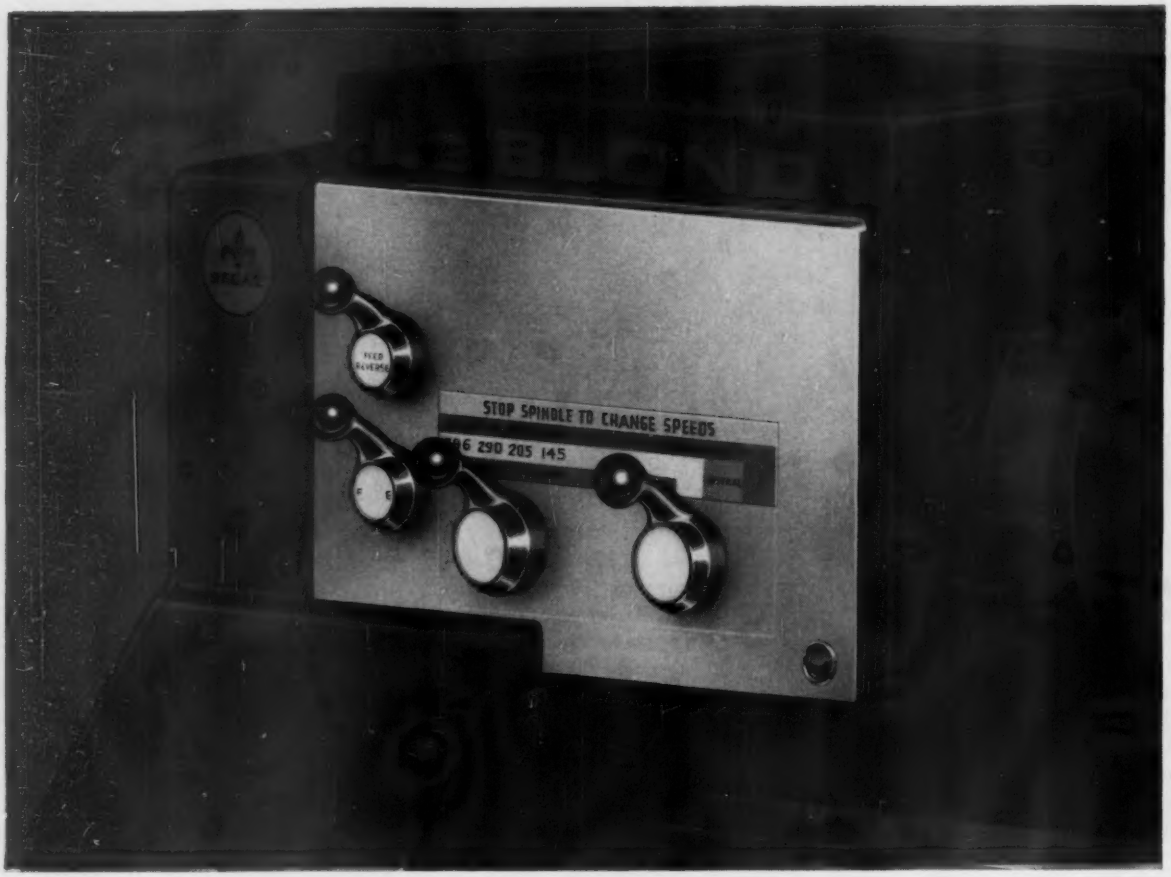
The decision is yours — can you afford not to reduce the time it takes to produce your product? Can you afford not to increase your productivity? Contact your Norton man, NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines

NORTON
MACHINE TOOLS

Making better products... to make your products better

new concept in Lathes



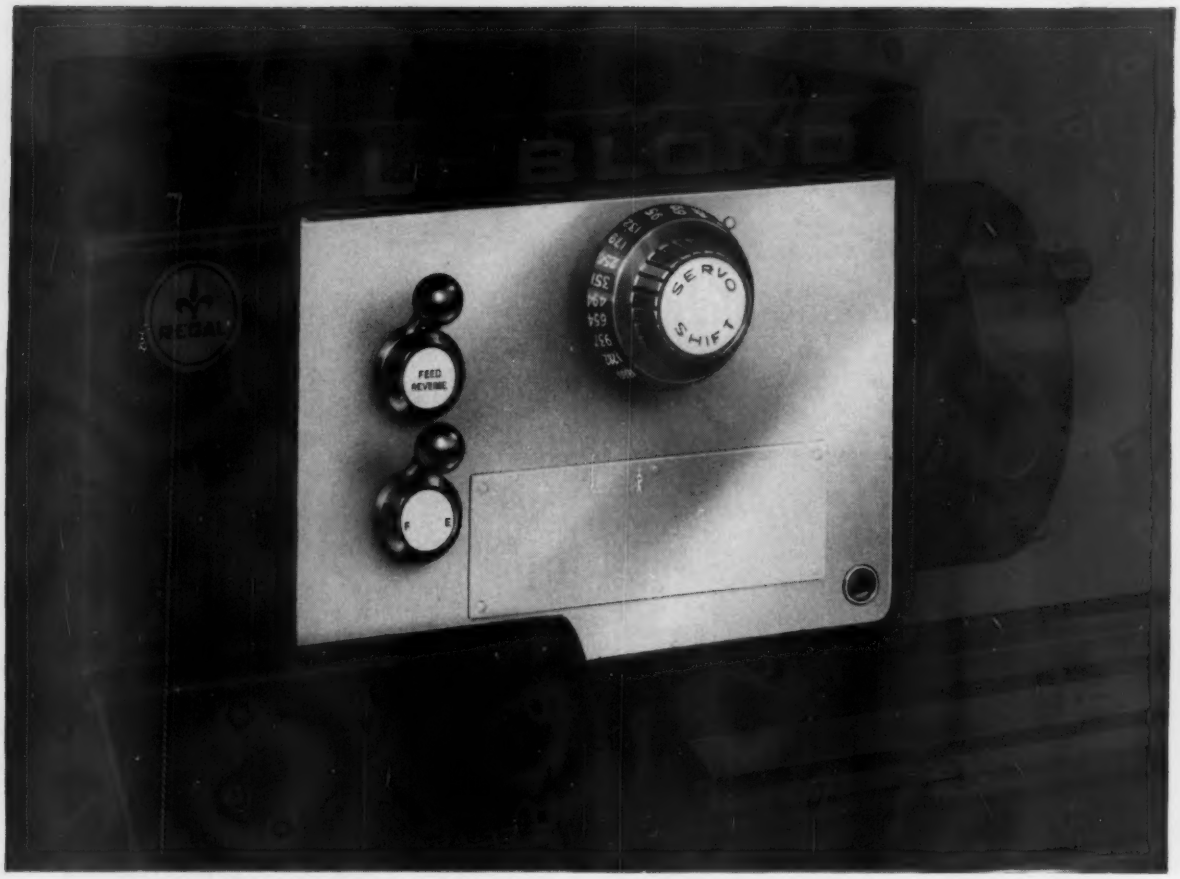
buy REGAL with manual shift....

Are you dubious about the advantages of hydraulic shifting on small lathes? Ingenious design of the new LeBlond Regal headstock lets you start with manual controls and add hydraulics in your shop at any time in the future! It's like having your cake and eating it, too.

The cost of adding the Servo-Shift package in the field is modest — just slightly more than original factory installation.

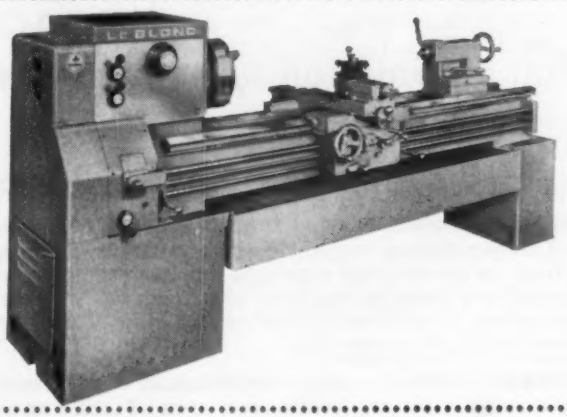
Brand new Regal Servo-Shift makes speed changing faster and easier than ever before. You select your next spindle speed while still cutting. Then move the control lever to brake position and get almost instantaneous automatic shifting—*with no clashing of gears!* This is the fastest and safest hydraulic shift available in a lathe today! It's simple and foolproof! It will make a hero out of every operator!

Our new Regal — the low-cost lathe with big-lathe features — has many more important advantages *not available in any other machine* of the same class. Ask us to have a LeBlond field engineer stop and tell you about them, or write for our new descriptive Bulletin R-961 A.



.....add SERVO-SHIFT later!

New LeBlond Regals are now available with 13", 15", 17" or 19" swing, and either manual or Servo-Shift.

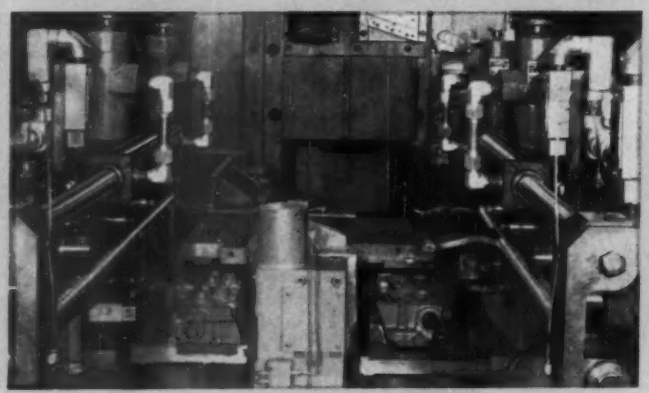


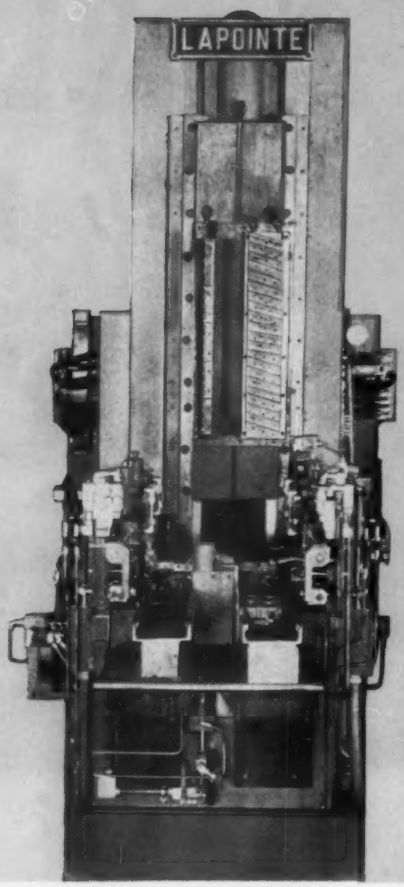
World's largest builder of a complete line of lathes.

LeBLOND of Cincinnati

The R. K. LeBLOND
MACHINE TOOL COMPANY
Cincinnati 8, Ohio

Original thinking paid off here!





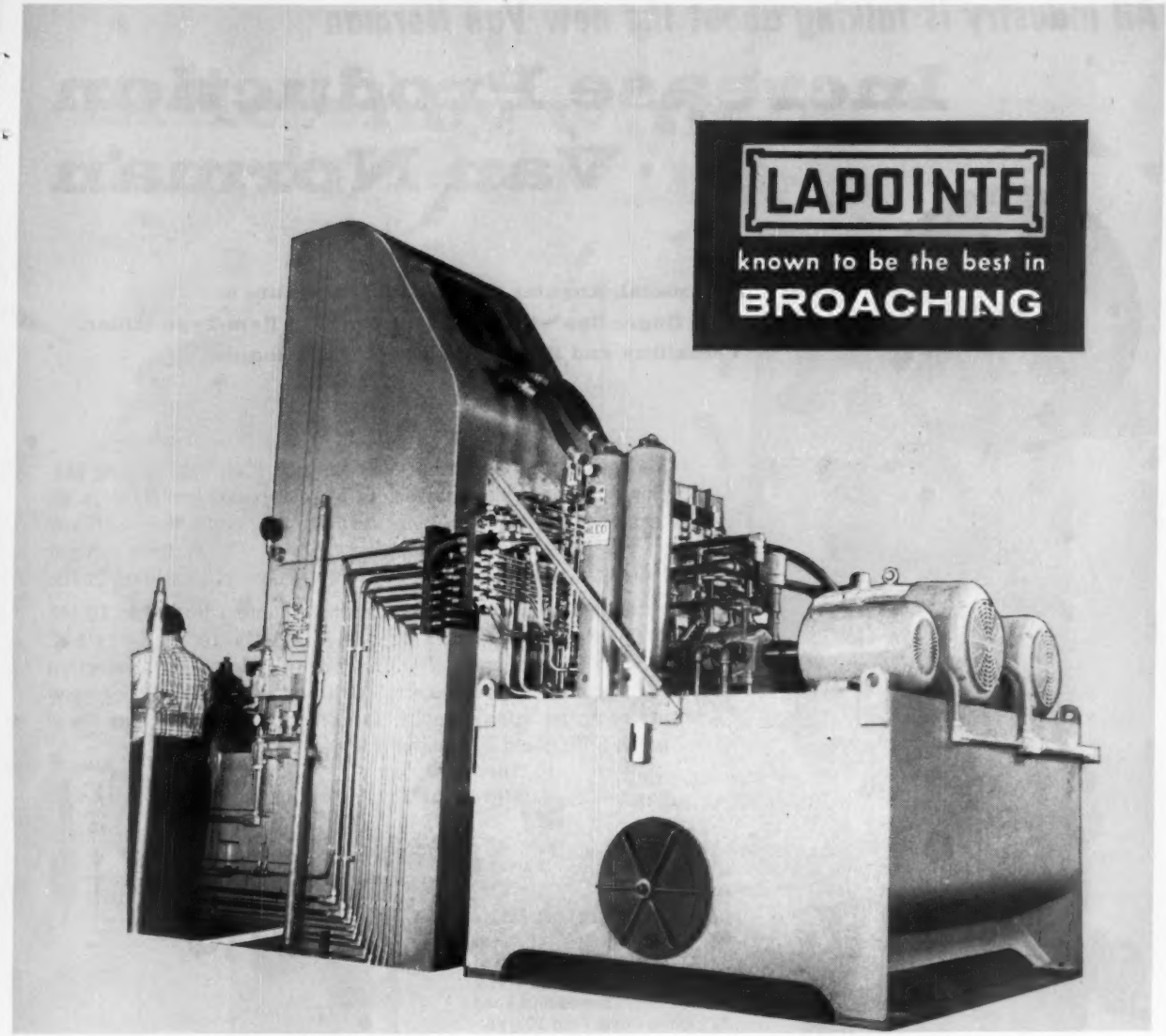
This vertical **LAPOINTE**

BROACHING MACHINE

with full automation can finish-broach the pressure face and the 20° angle face at the rate of 180 cylinder heads per hour!

Traditionally, an automotive cylinder head has always been broached on a horizontal broaching machine. That was the easy way, the obvious way. But when space limitations made it necessary to get away from the conventional approach, Lapointe engineers came up with this vertical broaching machine which is a complete departure from tradition. We dared to do something that had never been done before. In addition to substantial saving of floor space, there was a saving of many thousands of dollars of capital outlay.

It has rightly been said that the greatest potential for cost reduction exists in the field of broaching. May we suggest that you look again at some of your own production processes, and invite an experienced Lapointe Field Engineer to show you how to improve your production *and your quality* by converting to Lapointe-Broaching?



Completely automated, this is the special Lapointe SRV 15-ton, 66-inch stroke Single Ram Vertical Broaching Machine. It is equipped with a special Lapointe-patented Tip-Down fixture table on which is mounted an automatic, hydraulically-operated fixture to position and clamp the cast iron cylinder head for the broaching operation.

The pressure face is broached first, then the head is turned 180° in its fixture to broach the 20° angle. Stock removal is .020″ on each surface.

Rigidity of the machine makes it possible to use solid carbide blades for broaching. The broach assembly comprises the main holder and sub holders. Each carbide blade can be individually adjusted to obtain the correct "stepping".

Write for Lapointe Bulletin SRV

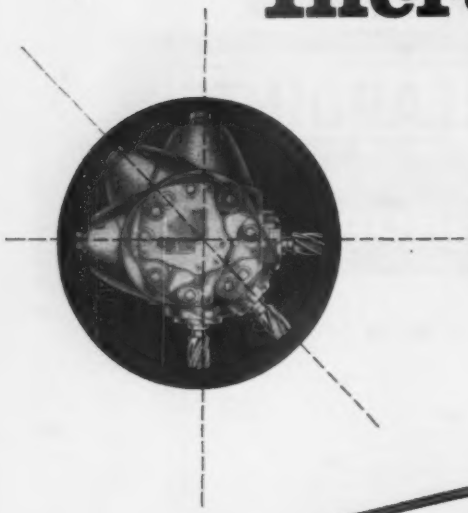
THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

All industry is talking about the new Van Norman

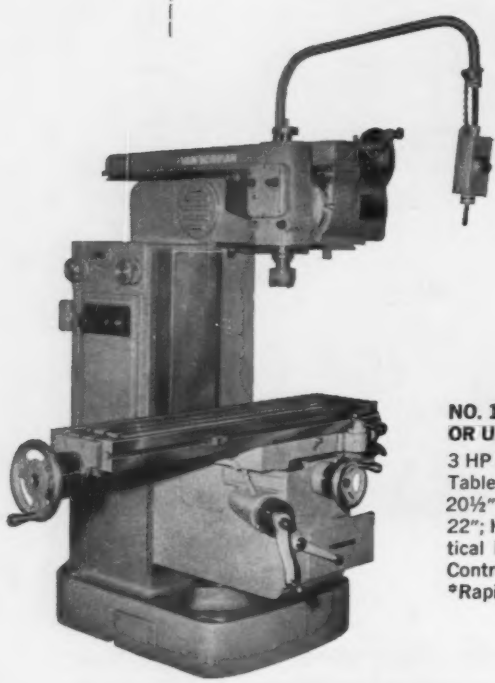
Increase Production Van Norman



Horizontal, Angular or Vertical Milling are at your finger-tips with ONE Van Norman Ram-Type Miller. Versatility and Range Pay Off in Performance

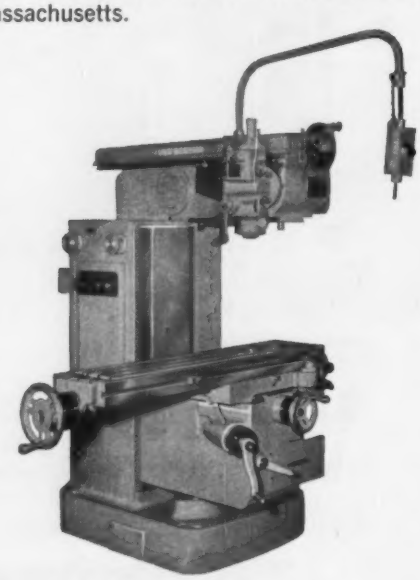
A single investment in one Van Norman Ram-Type Milling Machine gives you the equivalent of two separate millers plus attachments at the much lower cost of a single machine. Not only do you save machine dollars, but with a Van Norman you get increased production with substantial savings in milling costs.

14 new standard models — cutterhead motors from 3 to 10 HP (*15 HP optional)—table sizes from 42½" x 10" to 64" x 14" (*72" x 16" optional). You thus have a wide range of selection to fit your needs most exactly. Write for individual catalogs giving complete information. Mail to: Van Norman Machine Company, Springfield 7, Massachusetts.



NO. 1R (22-3)—PLAIN OR UNIVERSAL

3 HP Cutterhead Motor; Size of Table, 42½" x 10"; Ram Travel 20½"; Power Longitudinal Feed 22"; Hand Cross Feed 10"; Vertical Hand Feed 24"; Pendant Control.
*Rapid Traverse Knee Elevating



NO. 1RQ (22-3)—PLAIN OR UNIVERSAL

3 HP Cutterhead Motor; Size of Table, 42½" x 10"; Ram Travel, 20½"; Power Longitudinal Feed 22"; Hand Cross Feed 10"; Vertical Hand Feed 24"; Pendant Control; 4" Quill Travel; 3 Power Feeds (.0015" - .003" and .006" Feed per revolution).
*Rapid Traverse Knee Elevating
*Optional Equipment

FOR YOUR CONVENIENCE..
NEW NUMBER DESIGNATIONS FOR VAN NORMAN MACHINES

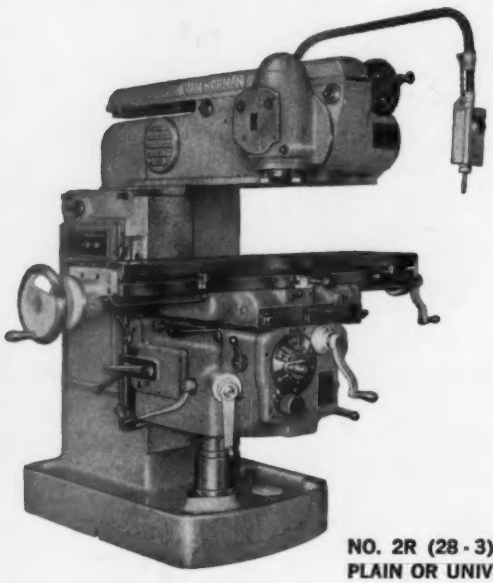
1	R	Q	22	3
Class	Ram Type	Quill Spindle	Table Travel	Spindle HP

VAN NORMAN MACHINE COMPANY

VN

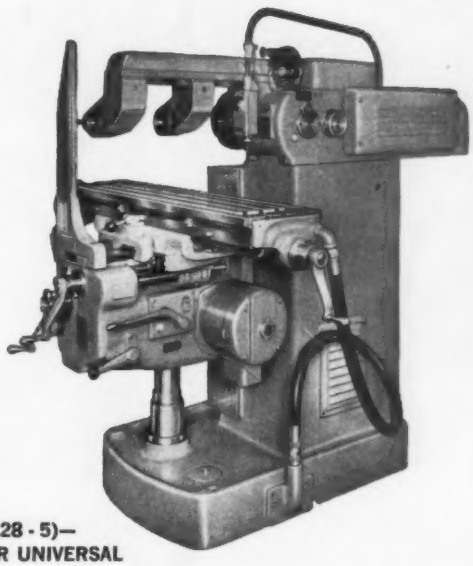
SPRINGFIELD 7, MASSACHUSETTS • DIVISION OF VAN NORMAN INDUSTRIES, INC.

Efficiency with Ram-Type Millers



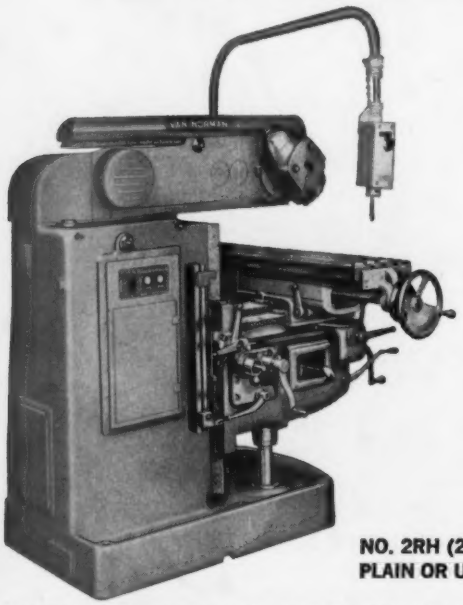
NO. 2R (28 - 3)—
PLAIN OR UNIVERSAL

3 HP Cutterhead Motor. Size of Table: 50" x 10½". Ram Travel: 29". Power Longitudinal Feed 28". Power Cross Feed 12". Power Vertical Feed 18". Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls.



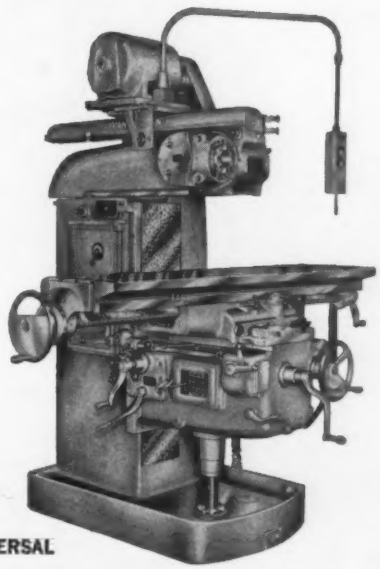
NO. 2R (28 - 5)—
PLAIN OR UNIVERSAL

5 HP Cutterhead Motor. Size of Table: 50" x 12". Ram Travel 25". Power Longitudinal Feed 28". Power Cross Feed 12". Power Vertical Feed 20". Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls.



NO. 2RH (28 - 7½)—
PLAIN OR UNIVERSAL

7½ HP Cutterhead Motor. Size of Table: 58" x 13". Ram Travel 29". Power Longitudinal Feed 28". Power Cross Feed 14". Power Vertical Feed 20". Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls.



NO. 38MA—
PLAIN OR UNIVERSAL

10 HP Cutterhead Motor. Size of Table: 64" x 14". Ram Travel 29". Power Longitudinal Feed 35". Power Cross Feed 14". Power Vertical Feed 21¼"; Rapid Traverse (6 Directions); Pendant Control; Front and Rear Hand Controls Automatic Backlash Eliminator with Plain Saddle.

Operator puts finishing touches on carbide reamer using Bay State Diamond Wheel (specially formulated to hold its shape and require minimum number of dressing operations).

BAY STATE TEAMWORK PAYS OFF AGAIN

with a new diamond wheel for SEVERANCE TOOL

When you use a substantial number of diamond wheels every month, it pays to keep a steely eye on costs. That's why a man like Purchasing Agent Millard Wells of the Severance Tool Industries, Saginaw, Michigan, insists on continuous testing for every cost factor in the book.

The specific problem was to develop an improved diamond wheel for close-tolerance grinding of Severance Carbide Reamers and at the same time to reduce time-consuming, material-wasting dressing operations.

Figuring out the details of the new wheel was a team operation right from the beginning. Bay State's Sales Engineering Staff and the Quality Control people in Westboro worked very closely with Jack Sullivan, of distributor Saginaw Supply Corporation and with Severance's Purchasing Agent Millard Wells.

Result: A specification that increased cutting speed and wheel life with substantially reduced dressing requirements ... and a beautiful demonstration of the benefits that accrue when two companies get together that both insist on quality right down the line.

Your Bay State distributor or direct representative can show you one of the most efficient lines of diamond wheels in the world manufactured with either man-made or natural diamonds . . . as well as offer you the services of a group of specialists whose knowledge of hard-materials grinding techniques is unparalleled. *Better grinding at lower cost . . . that is our business.*

Severance Purchasing Agent Millard Wells (left) and Bay State Distributor's representative Jack Sullivan (of Saginaw Supply Corp., Saginaw, Michigan) examine typical carbide tools which require diamond grinding.

BAY STATE WHEELS of PROGRESS

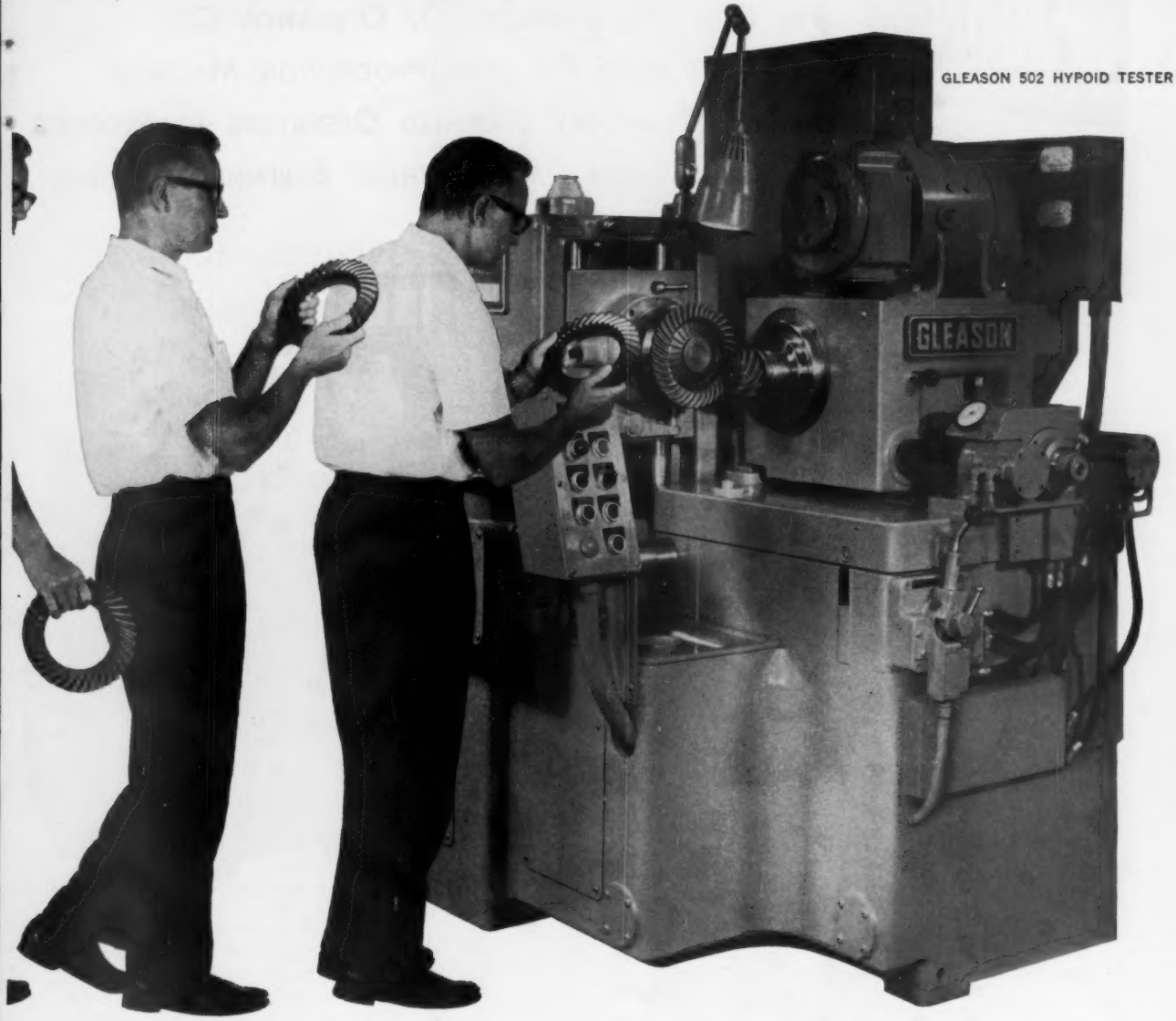
BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh.
Distributors: All principal cities.

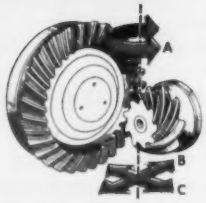
CIRCLE 276 READER SERVICE CARD

GLEASON 503 HYPOID LAPPER

NEW SPC* MOTIONS FOR PRECISION LAPPING AND TESTING



GLEASON 502 HYPOID TESTER



*Swing Pinion Cone lapping motions—the swing motion of the pinion head "A" moves the bearing along the length of the tooth. The axial motion of the pinion head "B" moves the bearing up and down the tooth profile, while the motion of the pinion head in the direction of the gear axis "C" maintains constant backlash.

Designed primarily for testing and lapping automotive spiral bevel and hypoid gears and pinions, these new Gleason machines afford more accurate control than was ever before possible in other machines. The end result —consistent, highly refined tooth surfaces which deliver the ultimate in smooth, quiet running drives.

The Gleason 503 Hypoid Lapper employs an entirely new lapping concept . . . SPC (Swing Pinion Cone). While gear and pinion are rotating together in a flow of lapping compound, the pinion head automatically and continually swings about a vertical axis which passes through the center of the tooth mesh; reciprocates along the pinion axis; and reciprocates along the gear axis. This three-way action laps the entire surface of each tooth from heel to toe. All machine motions and lapping times are separately controlled for drive and coast sides . . . also, machine may be set for extra lapping time at heel or toe if desired. Positive control of backlash, brake load, and lapping motions assure accurate product duplication from machine to machine . . . from job to job. This greater flexibility, combined with the ease of set-up and extreme accuracy of the 503, make it superior to previous lapping machines. The 503 handles gears up to 10½" diameter of any pitch.

The Gleason 502 Hypoid Tester is a companion machine to the 503 Lapper . . . simulates the SPC motions for accurately soft testing, matching, and final testing. Can also be run at spindle speeds up to 4000 rpm to approximate actual vehicle speeds. Handles bevel and hypoid gears up to 10½" O.D.

For full information write Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GLEASON

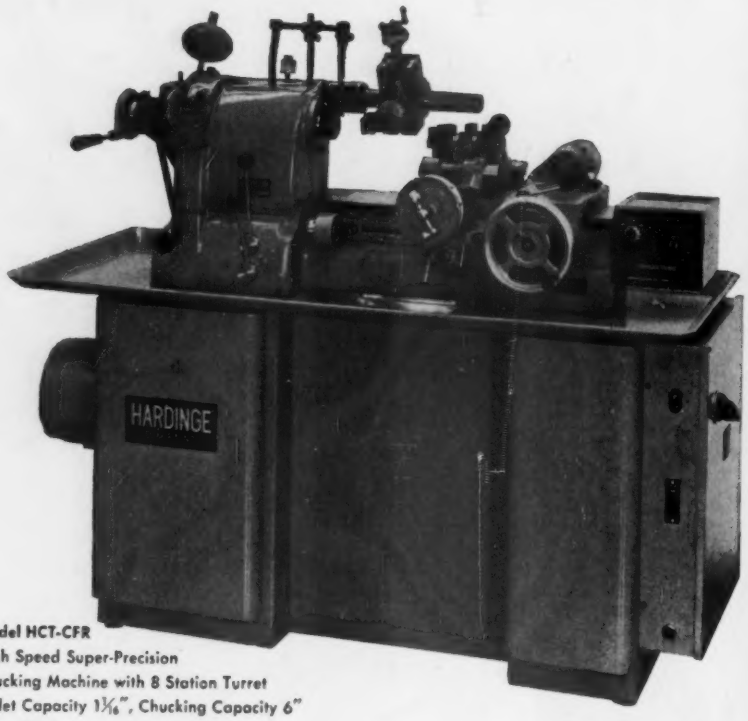
CIRCLE 278 READER SERVICE CARD

HARDINGE
ELMIRA, N.Y.

THE EASE AND SIMPLICITY OF OPERATION OF HARDINGE SUPER-PRECISION PRODUCTION MACHINES ENABLES RELATIVELY UNSKILLED OPERATORS TO PRODUCE PARTS TO CLOSE LIMITS WITHOUT EXPENSIVE TOOLING.

MODEL HCT-CFR

The Model HCT Chucking Machine can finish diameters, shoulders, and end faces, and cut precision threads in one setting—all concentric with each other. Adjustable, exact cutting positions produce closer tolerance parts on a production basis. It assures tool room accuracy and low part cost.



Model HCT-CFR
High Speed Super-Precision
Chucking Machine with 8 Station Turret
Collet Capacity 1 1/16", Chucking Capacity 6"

Model DSM59
High Speed Super-Precision
Second Operation Machine—Collet Capacity 1 1/16"

MODEL DSM59

This time-tested production machine is easy to set up and enables relatively inexperienced operators to turn out parts rapidly within close tolerances and to fine finish. Operations on this machine reduce expensive tooling, upkeep, and down time of automatics.

Ask your Hardinge Sales Engineer for Complete Details

CIRCLE 279 READER SERVICE CARD

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

The "cool" abrasive vital to ultrasonic machining . . .

NORBIDE* boron carbide

The Raytheon Company, a leading manufacturer of ultrasonic impact grinders defines the ultrasonic process as including:

. . . "*mechanical vibration at 25,000 cycles per second, above the range of the human ear . . . amplified and transmitted to the cutting tool . . . Tiny particles of abrasive are accelerated . . . and driven with tremendous impact against the work, thereby chipping or grinding an exact counterpart of the tool face into the work . . . This . . . together with the vibrating nature of the process, plus the absence of direct tool-to-work contact and the presence of the cool abrasive, make impact grinding a cool-cutting process. The work material is not stressed or distorted in any way, and is not raised in temperature.*"

Recommended by Raytheon, Norton NORBIDE boron carbide is the ideal cool-cutting abrasive for ultrasonic grinding and machining.

Always recognized as second only to diamonds in hardness, and as much more suitable for ultrasonic impact than silicon carbide grain, this Norton achievement has been recently improved to even higher effectiveness.

And now, improved NORBIDE boron carbide has greater freedom from impurities — which assures greater, longer lasting cutting power in each ounce of grain.

Raytheon Ultrasonic Impact Grinders are widely used for slicing of semiconductor wafers, as shown, and in later dicing of the wafers. Other machining operations include drilling, engraving, broaching, trepanning, shaping, shaving, lapping etc. Driven against the work with an impact force of 150,000 times its own weight, NORBIDE boron carbide grain is recommended by the Raytheon Company as the "cool" abrasive that meets every requirement for high precision, trouble-free cutting action.

Your Norton Man will be glad to tell you how ultrasonic machining is opening up new potentialities in many manufacturing fields, applied to a variety of materials — and how improved NORBIDE boron carbide can benefit your own operations in this modern field. See your Norton Distributor or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

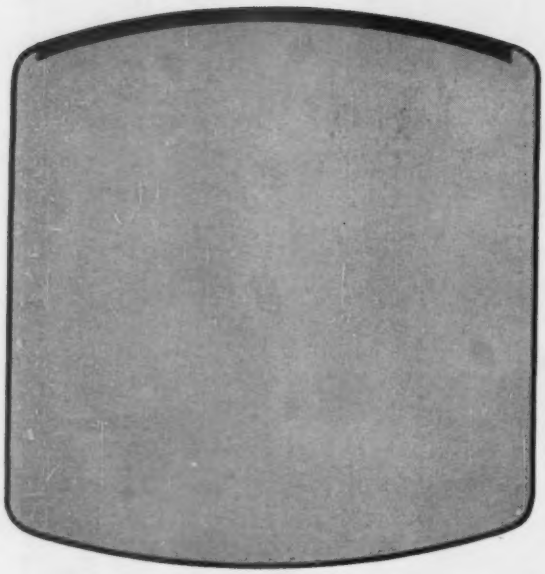
G-415

NORTON
BORON CARBIDE

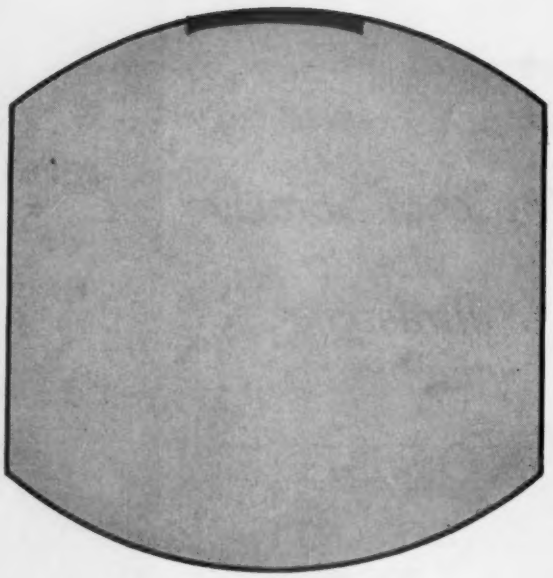
*Trade Mark Reg. U.S. Pat. Off. and Foreign Countries.

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



NEW: Now, SKF's improved "C" type design extends contact area over the entire length of a longer roller element.



OLD: In older flanged type bearings, effective contact area was no longer than the red line.

CAPACITY:

SKF's new "C" type bearing increases capacity as much as 54% by giving the roller some growing space.

The space was always there, but, until the SKF "C" type bearing, it was occupied by undercuts and fixed flanges. SKF removed them so the roller could be lengthened over a wider raceway.

Result: *The SKF "C" type bearing increases capacity up to 54%—corresponding to more than 4 times longer service life.*

SKF PUT THE GREATER LENGTH TO WORK. Length alone is not enough. It's only the raw potential for greater load-carrying capacity. A high capacity bearing has to be designed to *realize* that potential. Here's how the "C" type does it:

- CLOSE OSCULATION, that is close conformity between rings and rollers, distributes load evenly over the *entire* length of the roller.
- AN AXIALLY FLOATING FLANGE, combined with the symmetrical roller, assures automatic and *even* distribution of load under any combination of radial and thrust loads.

See for yourself! Ask your SKF man to show you his desk top demonstration of the new "C" type bearing. 6127

SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

Exclusive New Britain design
for greater boring accuracy

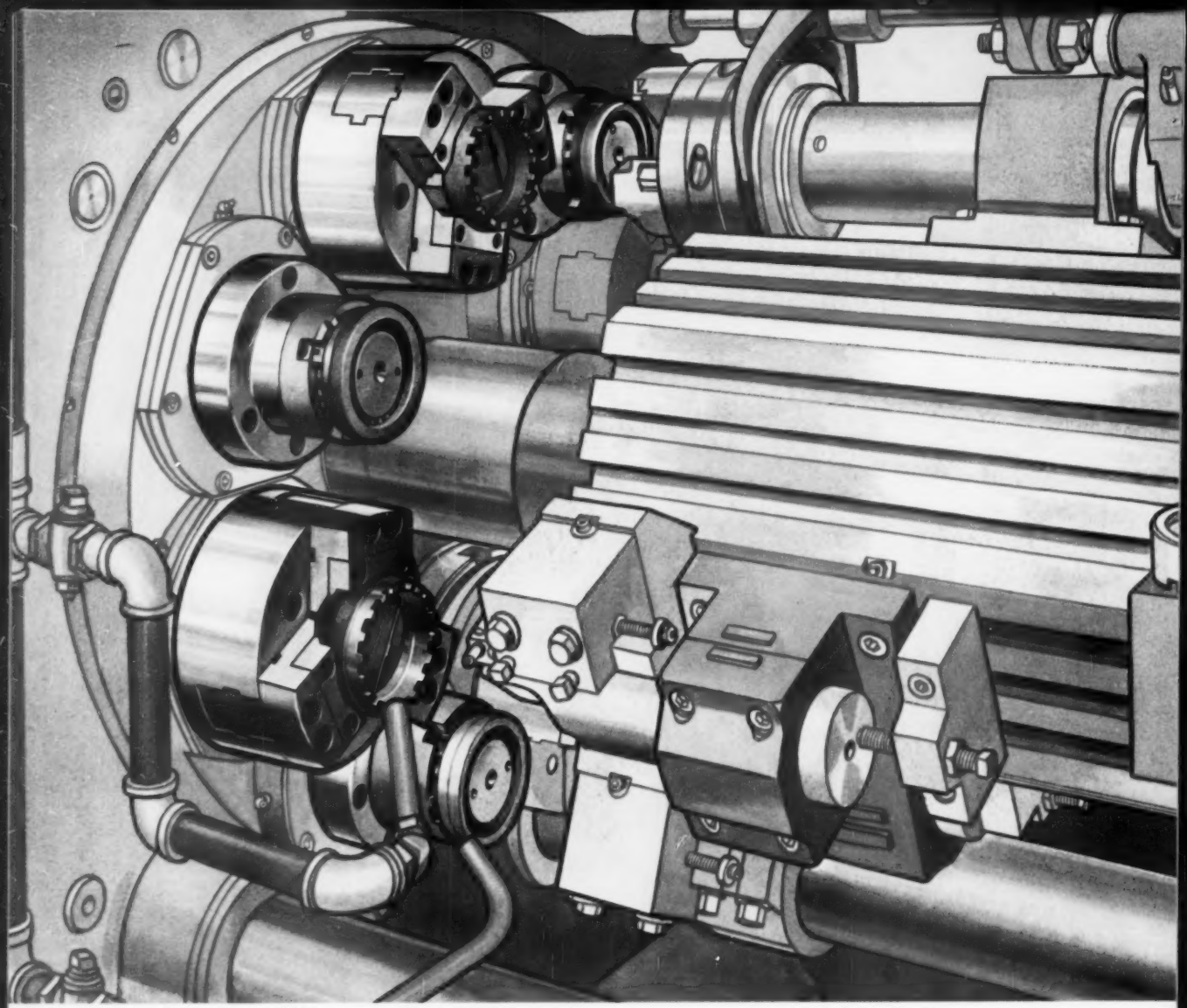
This is the vertical slide of one of the new series New Britain Vertical Contour Turning and Boring Machines with the front plate removed exposing the cams. These cams are mounted on a common shaft which rides with the vertical slide controlling its motion as well as the motion of the cross slide. Containing all slide actuating forces in the vertical slide is an exclusive New Britain feature which represents a major development in boring machine design.

No outside forces are imposed on the slide ways. Extreme accuracy and rigidity are achieved permitting heavy cuts. Finish cuts of less than .0003 tolerance can be made on the same set-up.

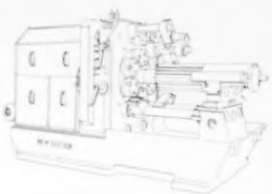
The elimination of long actuating linkages has allowed for the design of a compact, clean sided, simplified machine. Cams are quickly accessible and easy to change.

The major improvement which the cam-in-head principle makes on the already widely accepted superiority of cam control results in high repetitive accuracy regardless of the complexity of the piece. Building-block applications, using more than one machine side by side, allow all kinds of possibilities for increased production efficiency.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division ◆ New Britain, Connecticut



Double indexing... differential chucking pressures *with New Britains*



Here are two features that go a long way toward indicating how much and what kind of work you can do on New Britain's Chuckers. The double indexing feature is a really workable approach to the production of two identical pieces per cycle or both sides of a piece. This application can frequently eliminate the need for second-operation machines. Chucking pressures can be adjusted so that as the machine progresses through the cycle, and more and more metal is removed, the piece will not be distorted.

These are only two of a dozen different New Britain Chucking Machine features. These rugged, powerful machines are your best bet for high production turning, forming, facing, threading, tapping and related operations. New Britain's complete line of chuckers includes four-, six- and eight-spindle models, with work swing up to 17 inches. Wide open design in all models allows for the quickest possible disposition of chips.

Make a point of calling in your New Britain representative soon. Let him show you the dollars and cents reasons for including New Britains in your replacement or expansion plans.

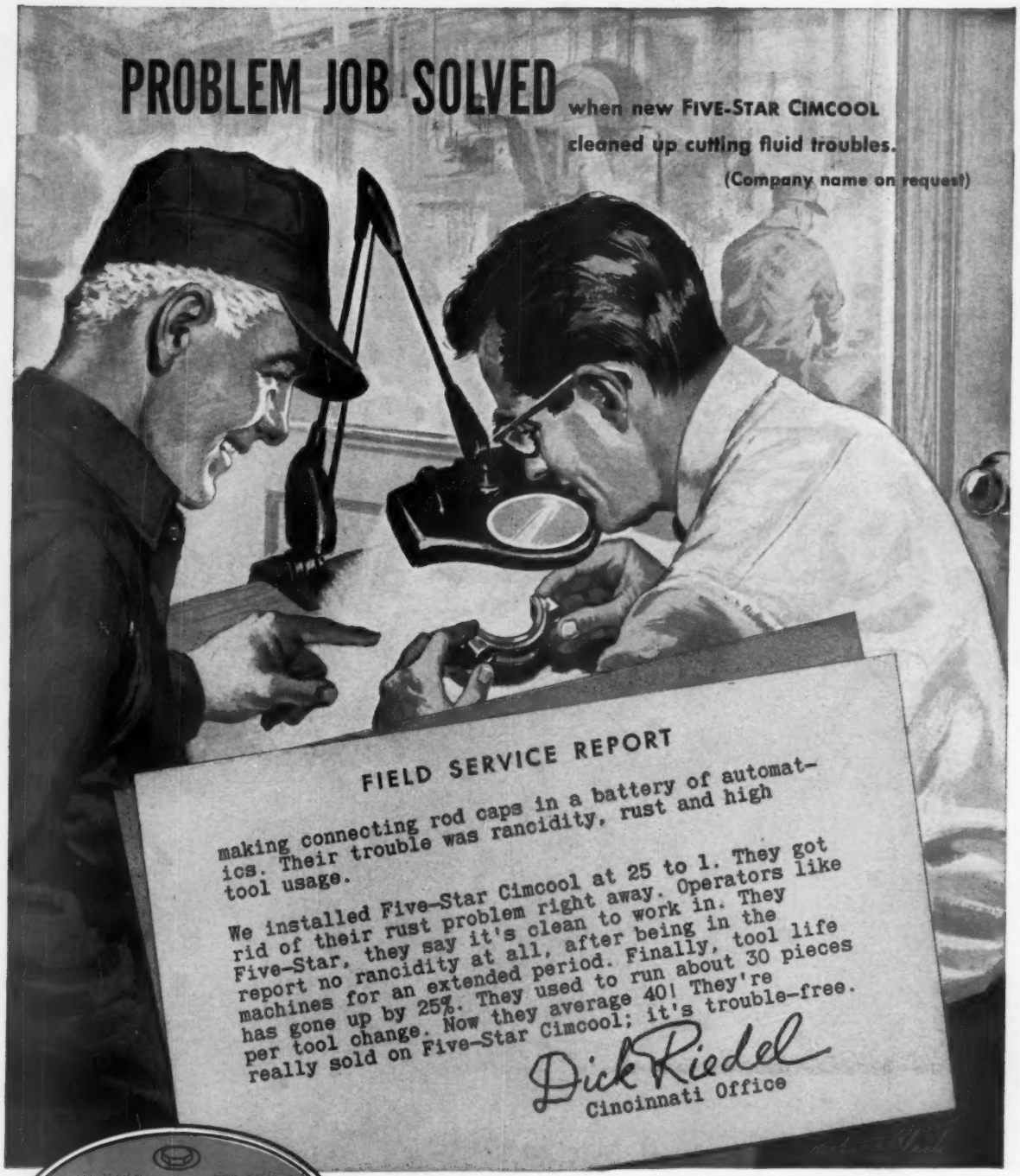
THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division ◆ New Britain, Connecticut

PROBLEM JOB SOLVED

when new FIVE-STAR CIMCOOL cleaned up cutting fluid troubles.

(Company name on request)

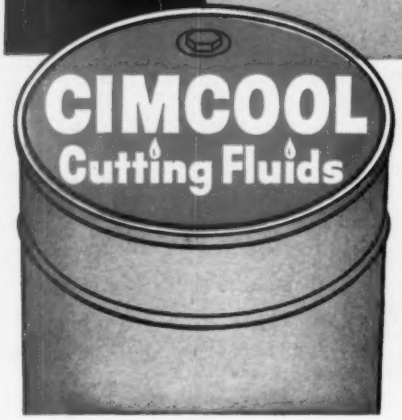


FIELD SERVICE REPORT

making connecting rod caps in a battery of automatics. Their trouble was rancidity, rust and high tool usage.

We installed Five-Star Cimcool at 25 to 1. They got rid of their rust problem right away. Operators like Five-Star, they say it's clean to work in. They report no rancidity at all, after being in the machines for an extended period. Finally, tool life has gone up by 25%. They used to run about 30 pieces per tool change. Now they average 40! They're really sold on Five-Star Cimcool; it's trouble-free.

Dick Riedel
Cincinnati Office



FOR 100% OF ALL METAL CUTTING JOBS

Production-Proved products of The Cincinnati Milling Machine Co.

FIVE-STAR CIMCOOL—Newest in the industry-proven line of CIMCOOL° Cutting Fluids.
CIMPERIAL° — Heavy duty replacement for cutting oils in those low-speed tough jobs.
CIMPLUS — The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS) — For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

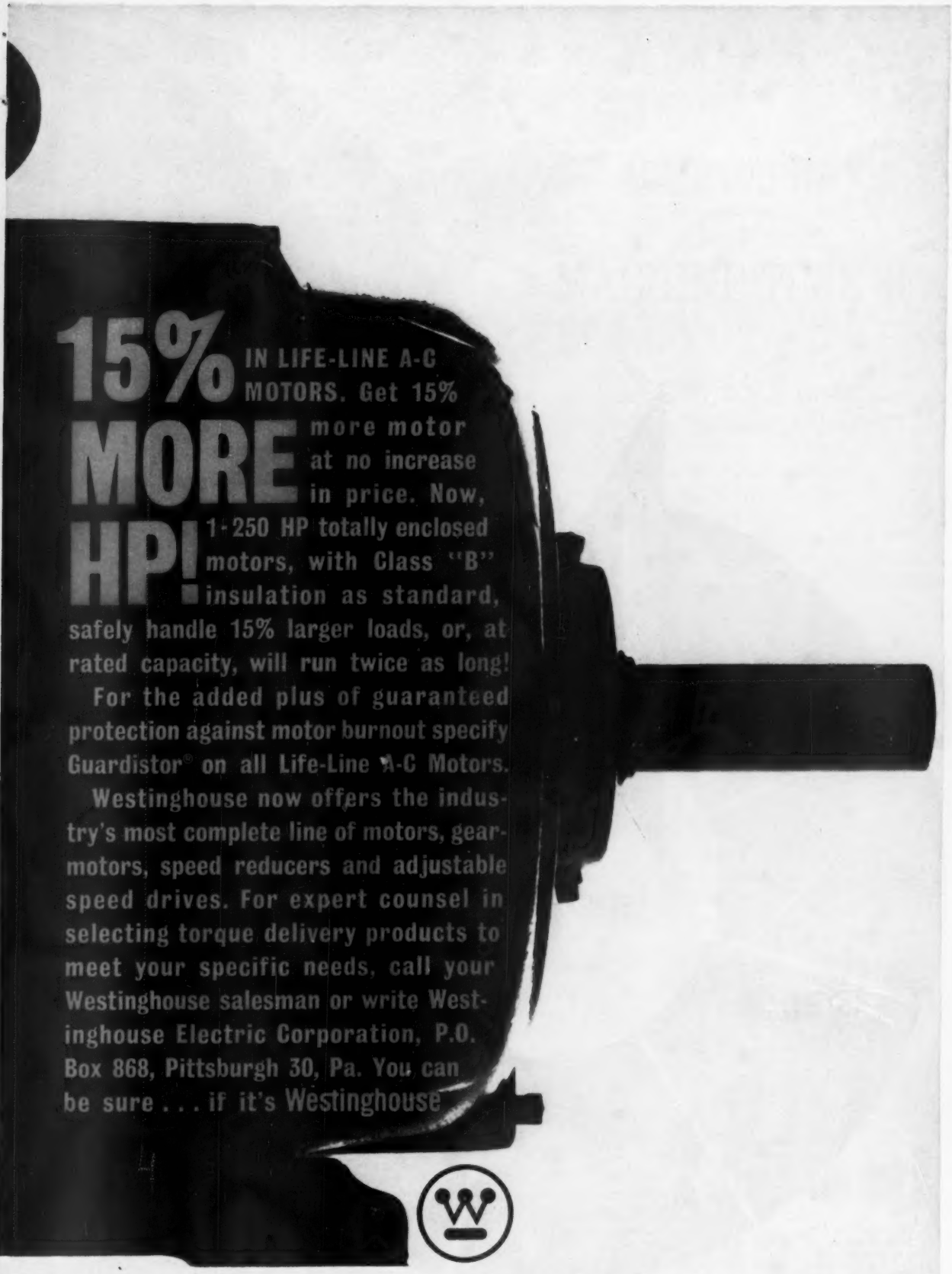
For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

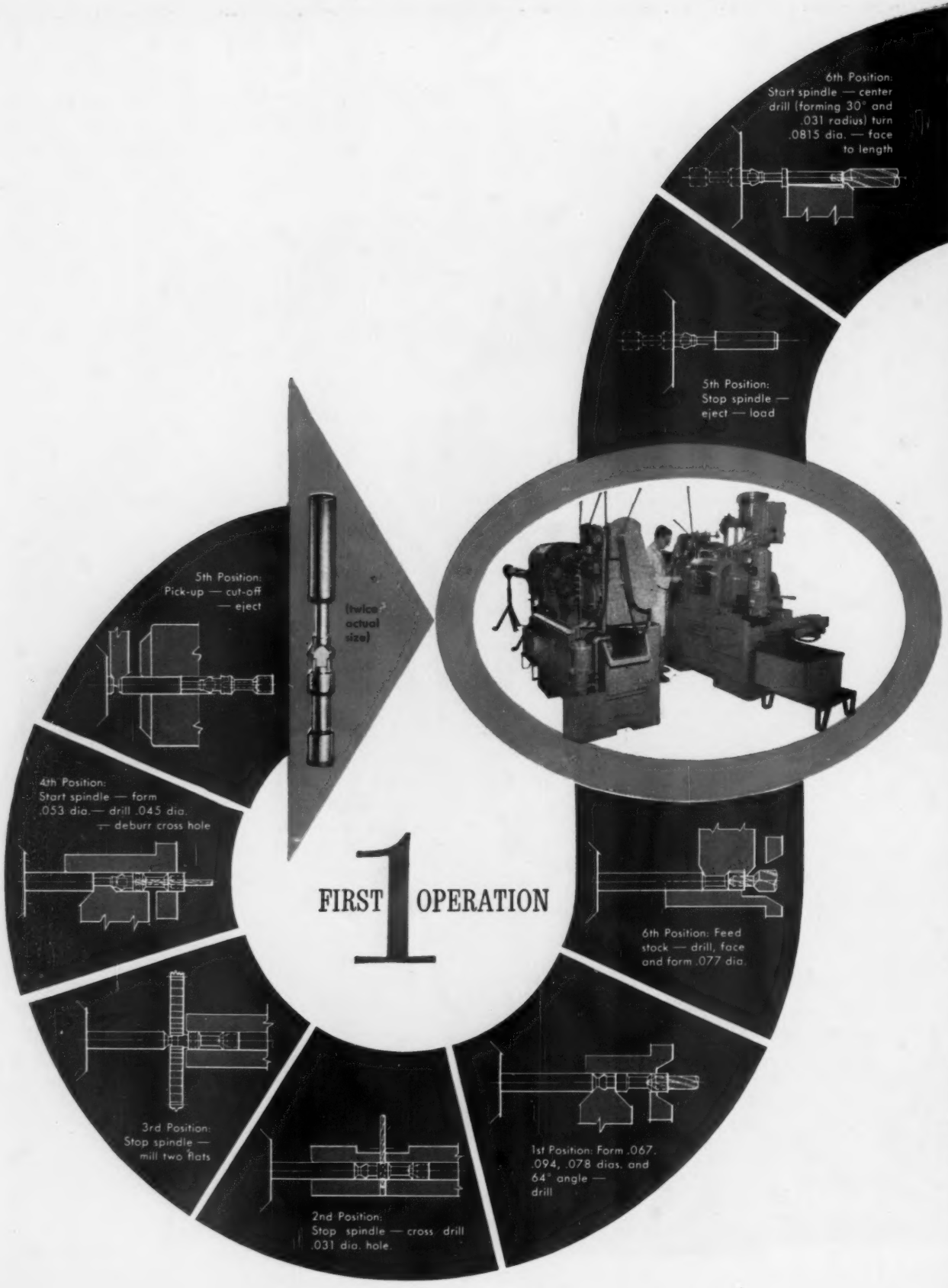
°Trade Marks Reg. U.S. Pat. Off.

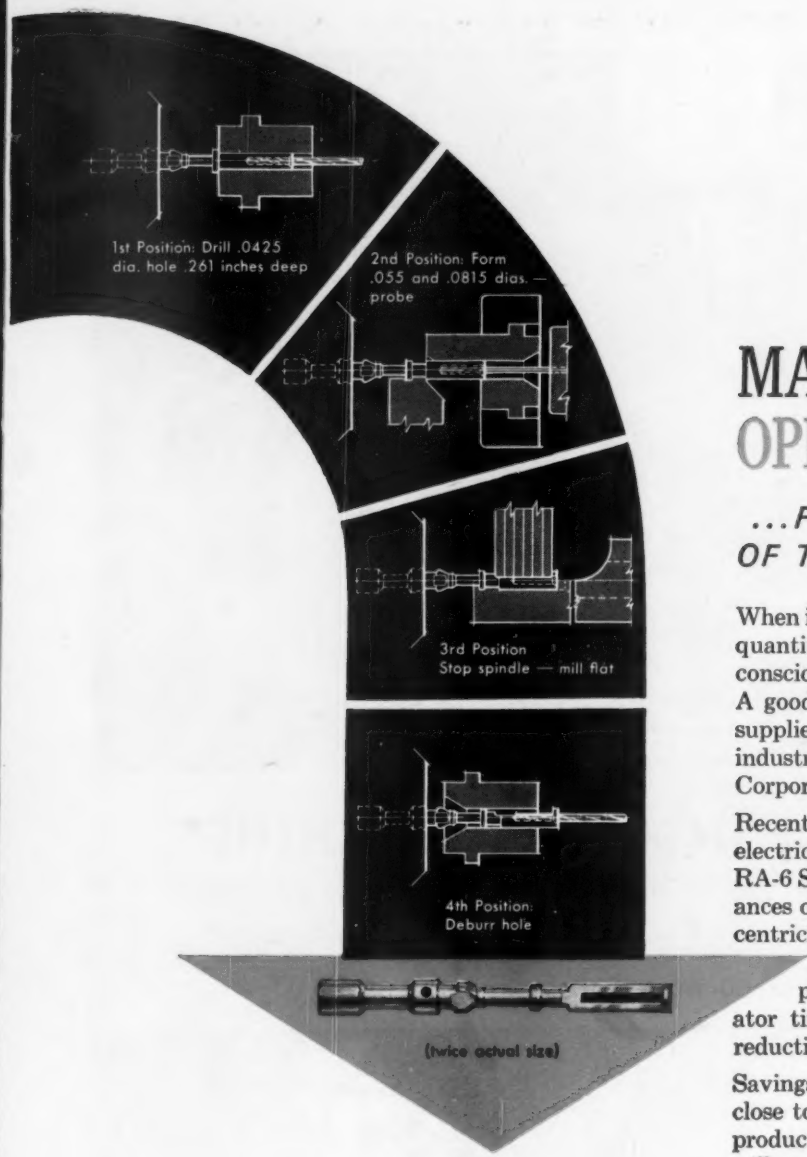
◀ CIRCLE 283 READER SERVICE CARD

CIRCLE 284 READER SERVICE CARD

J-22174


15% IN LIFE-LINE A-C MOTORS. Get 15% MORE more motor at no increase in price. Now, HP! 1-250 HP totally enclosed motors, with Class "B" insulation as standard, safely handle 15% larger loads, or, at rated capacity, will run twice as long!
For the added plus of guaranteed protection against motor burnout specify Guardistor® on all Life-Line A-C Motors.
Westinghouse now offers the industry's most complete line of motors, gearmotors, speed reducers and adjustable speed drives. For expert counsel in selecting torque delivery products to meet your specific needs, call your Westinghouse salesman or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse


6th Position:
Start spindle — center drill (forming 30° and .031 radius) turn .0815 dia. — face to length
5th Position:
Stop spindle — eject — load
(twice actual size)
5th Position:
Pick-up — cut-off — eject
4th Position:
Start spindle — form .053 dia.— drill .045 dia. — deburr cross hole
FIRST 1 OPERATION
6th Position: Feed stock — drill, face and form .077 dia.
1st Position: Form .067, .094, .078 dias. and 64° angle — drill
2nd Position:
Stop spindle — cross drill .031 dia. hole.
3rd Position:
Stop spindle — mill two flats


1st Position: Drill .0425 dia. hole .261 inches deep
2nd Position: Form .055 and .0815 dias. — probe
3rd Position Stop spindle — mill flat
4th Position: Deburr hole
(twice actual size)

ACME-GRIDLEYS REDUCE MACHINE TIME 80% OPERATOR TIME 70%

...FOR SCINTILLA DIVISION OF THE BENDIX CORPORATION

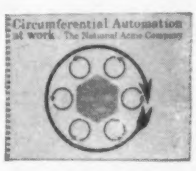
When it comes to economically turning out large quantities of identical precision parts, most cost-conscious manufacturers rely on Acme-Gridleys. A good example is one of the nation's leading suppliers of electrical connectors to space age industries, Scintilla Division of The Bendix Corporation, Sidney, New York.

Recently, Scintilla converted production of an electrical contact socket and connector to 7/16" RA-6 Spindle Acme-Gridleys. Working to tolerances of .002 on turned diameters, .005 on concentricities and 50 microinches or better on drilled holes, the Acme-Gridleys reduced per-piece machine time 80% and operator time 70%! There was also a significant reduction in the reject rate.

Savings like this are the big reason Scintilla has close to *seventy* Acme-Gridleys in their modern production setup. In your plant, Acme-Gridleys will pay off in similar cost reductions . . . for years to come.

SECOND 2 OPERATION

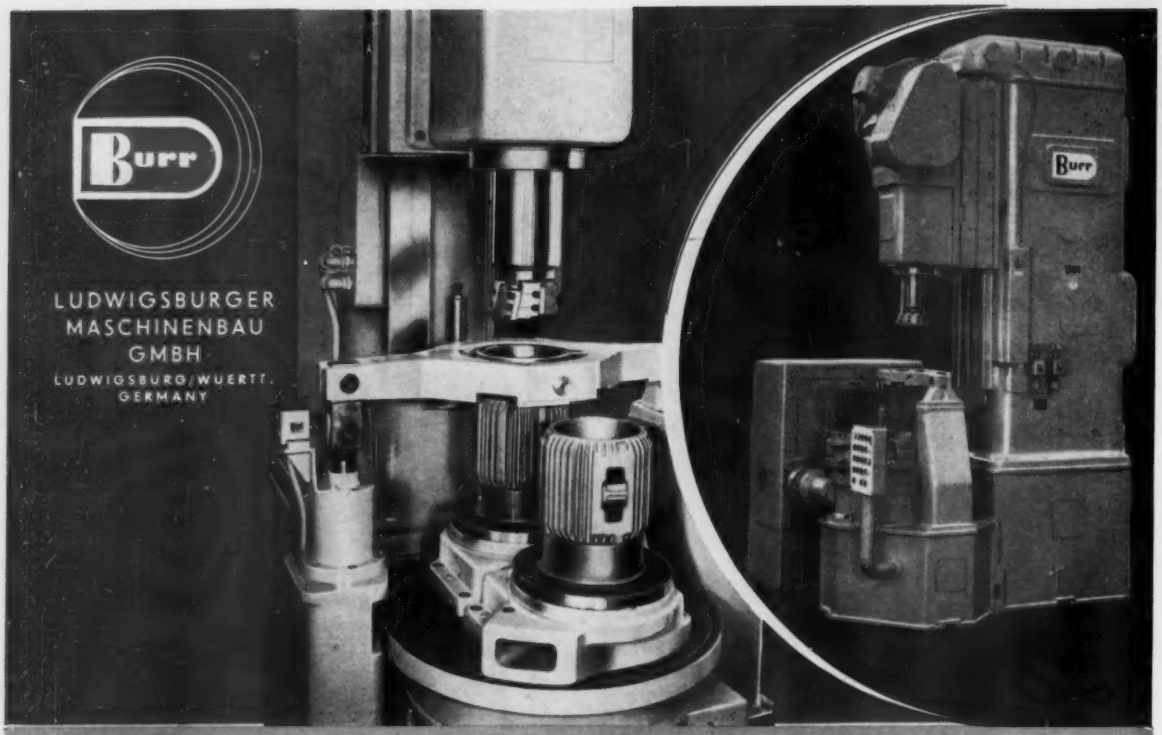
The number of different jobs that can be set up on Acme-Gridleys amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64-page bulletin called "Circumferential Automation at Work". At your request, we'll be happy to send you a copy. Call, write or wire.



National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

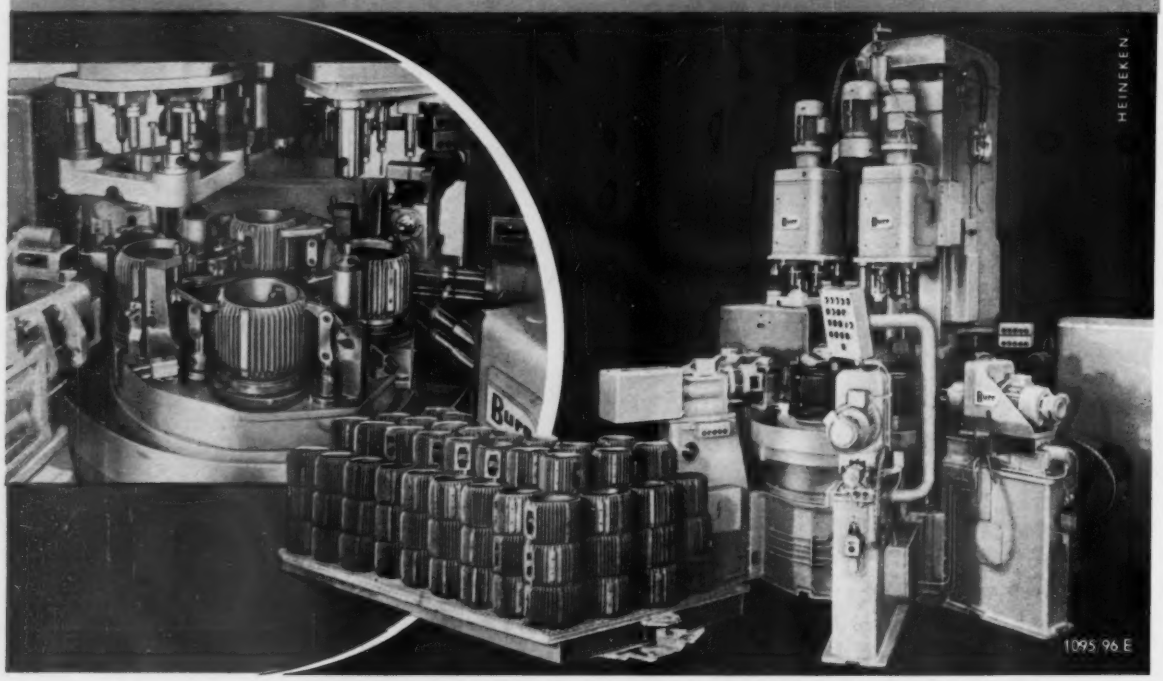


ROTARY TABLE INDEXING MACHINES

FOR ROUGH AND FINISH-MACHINING ELECTRIC MOTOR CASINGS

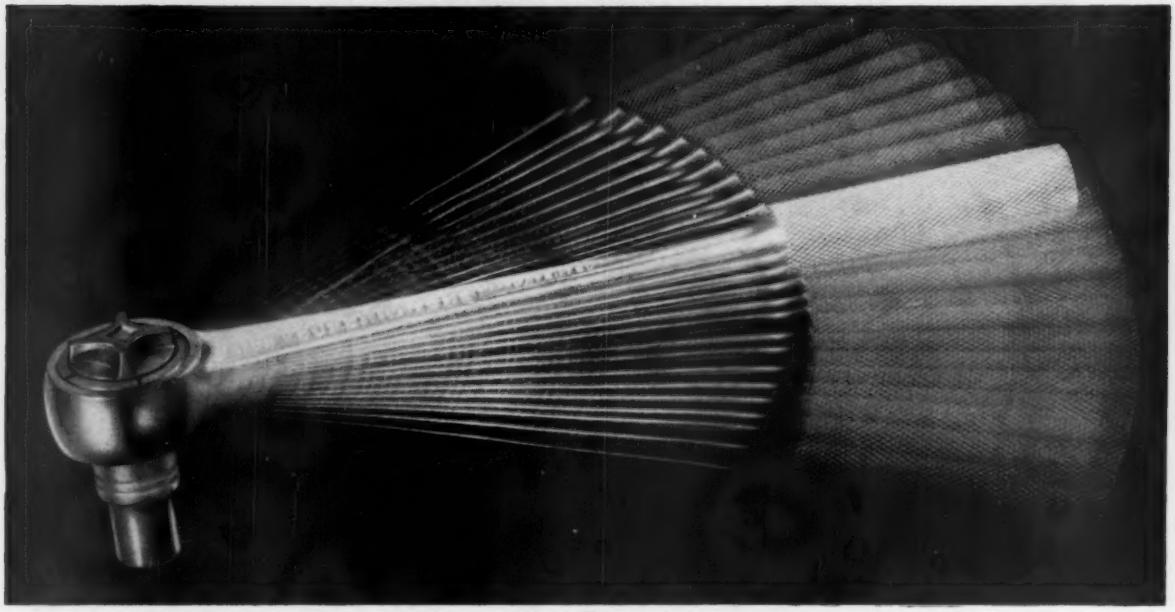
The machines can be tooled for workpieces ranging from 130-280 mm bore-dia.

Output: 30-60 workpieces per hour

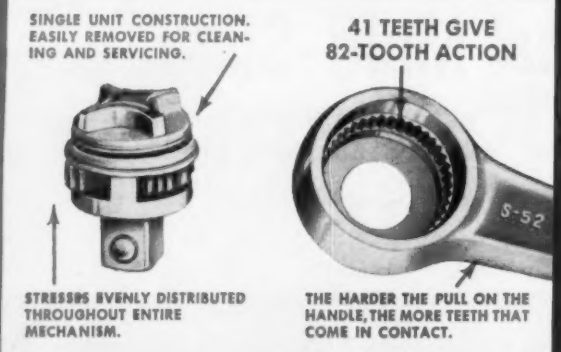


Get the swing with WILLIAMS ⅜" and ½" diameter *SUPERRATCHETS*®.

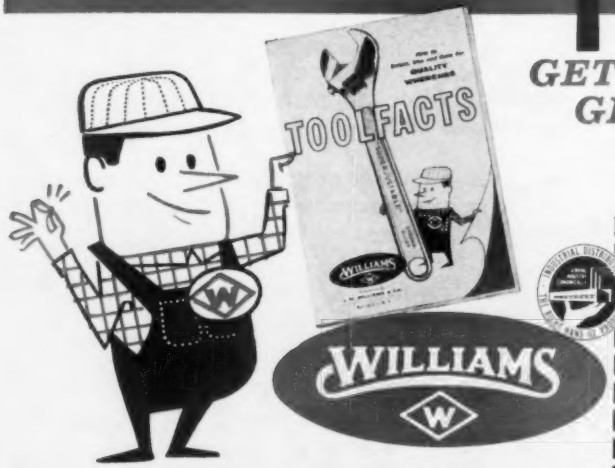
Complete nut rotation requires less than 4½° swing. Long handle is proportioned for ideal balance, comfort and leverage.



Get the features Modern design and manufacture combine to produce a ratchet 50% stronger than U.S. Government requirements with these quality features:


SINGLE UNIT CONSTRUCTION. EASILY REMOVED FOR CLEANING AND SERVICING.
STRESSES EVENLY DISTRIBUTED THROUGHOUT ENTIRE MECHANISM.

Get the flexibility 88 Drivers and attachments in ¼", ⅜", ½", ¾" and 1" drive sizes, plus 254 sockets, offer endless combinations to solve any nut-turning problem.

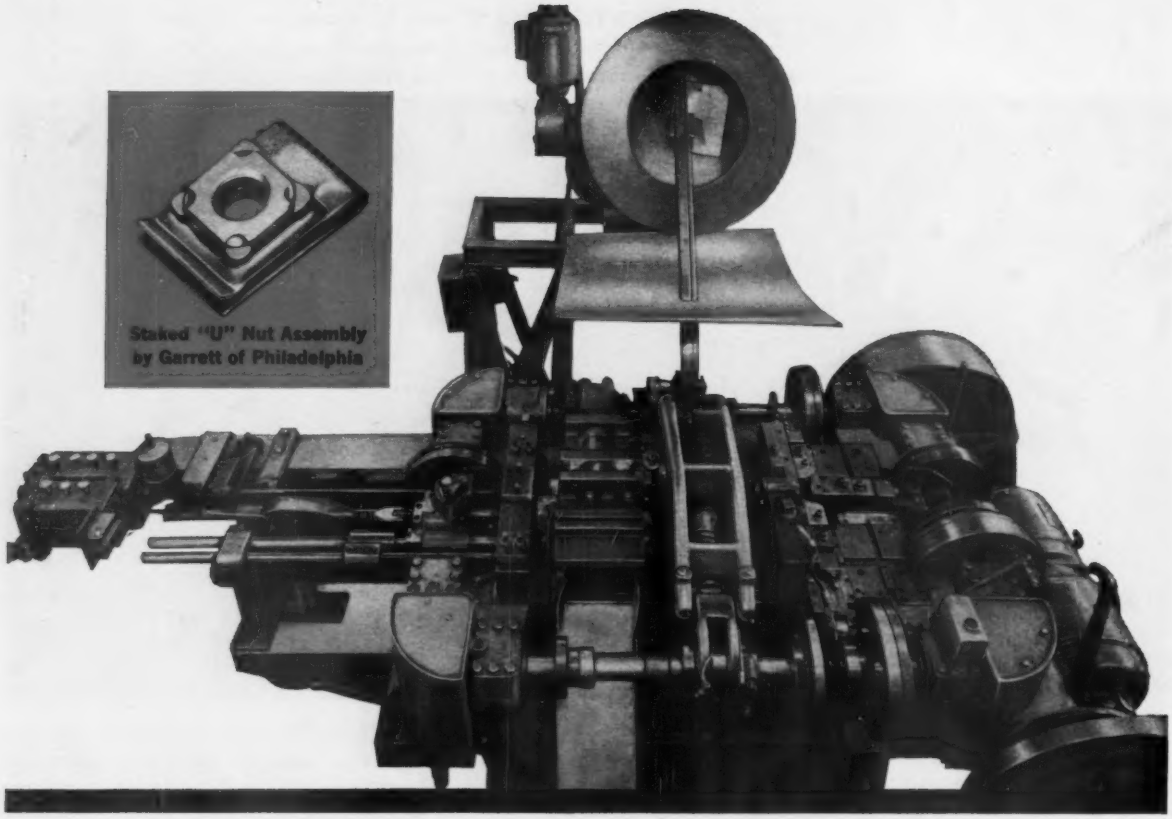


GET THE FACTS... GET TOOLFACTS... MR. WRENCH suggests that you send for this New 24-page booklet on How to Select, Use and Care for Quality Wrenches.

J. H. WILLIAMS & CO., 408 VULCAN ST., BUFFALO 7, N. Y.
Division of United-Greenfield Corporation

Mr. Wrench: Please send me your new
☐ TOOLFACTS Booklet ☐ ILLUSTRATED CATALOG No. 304

NAME_____ TITLE_____
FIRM_____
STREET_____
CITY_____ ZONE_____ STATE_____



U.S. symmetrical Multi-Slide® produces staked "U" nut assemblies in one operation!

The No. 33 U. S. Symmetrical Multi-Slide shown above—one of the many in use by The George K. Garrett Company, Inc., of Philadelphia, is producing Garrett's Staked "U" Nut Assembly. Conventional production of this assembly requires 3 separate operations... stamping of blank, assembling and staking before forming, and finish forming.

Now, with the U. S. No. 33 Symmetrical Multi-Slide, the 3 operations are combined and performed by this one U. S. Multi-Slide—which produces complete, Staked "U" Nut Assemblies at the rate of 140 per minute.

This is another example of the cost reduction and time saving advantages U. S. Multi-Slides can and do make possible.

Write for full information on U. S. Multi-Slides —ask for Bulletin No. 15. A

MULTI-SLIDE

U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

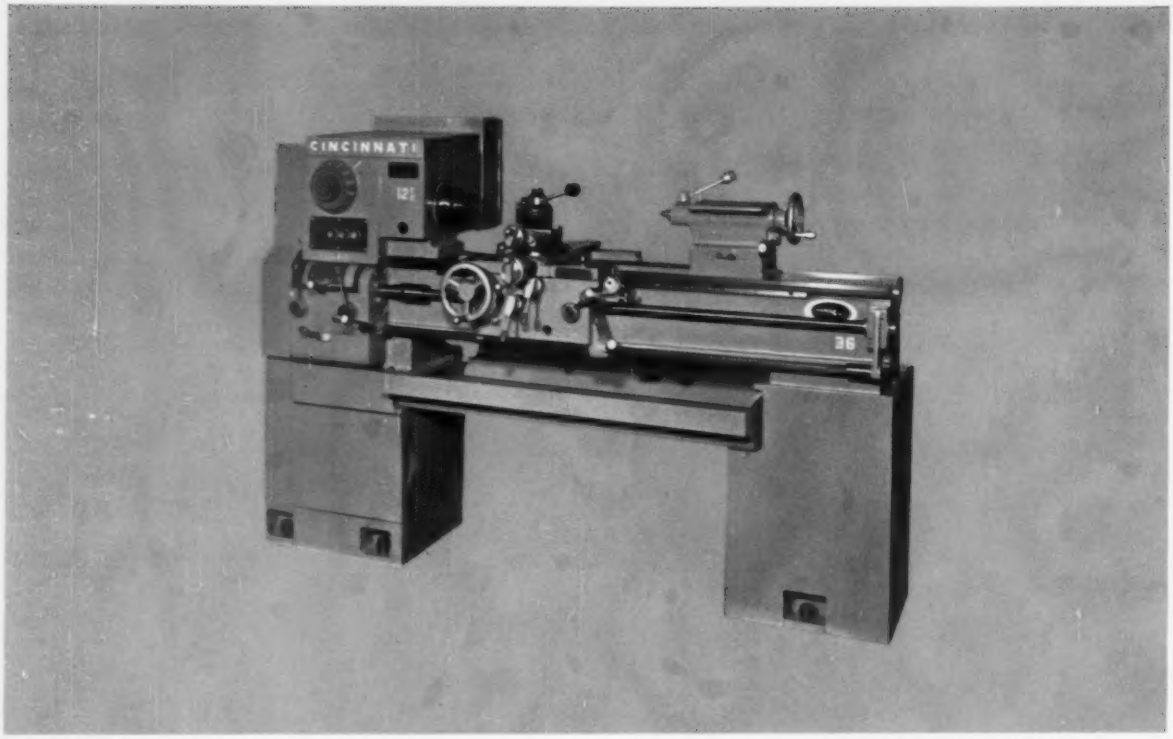
Pre-selected speeds finish lathe jobs in half the time

Development and production schedules at Moog Servocontrols, Inc. don't allow for waste motion. That's one reason why this manufacturer is enthusiastic about the 15-inch Cincinnati HYDRASHIFT lathe recently installed at the Paramus, N.J., Research Laboratory. Pre-selected speed shifting puts the machine one step ahead of each operation, ready to start the next without delay.

A typical job for the HYDRASHIFT at Moog is machining prototype injector housings from three-inch stainless steel bars. Formerly, the bars were blanked into work pieces on a bandsaw, but the HYDRASHIFT lathe now takes these heavy initial cuts in stride. Time saved on this first operation alone is at least two thirds. For all machining—which includes five speed changes and a tool change—the HYDRASHIFT requires only half as much time as the old method.

Cincinnati Lathe and Tool Co. builds HYDRASHIFT lathes in six sizes, from 10-inch to 26-inch, with a broad selection of horsepower ratings, spindle speeds, feed ranges, swing sizes and bed lengths to suit any application. For more information on details and specifications, turn the page.

CINCINNATI



HYDRASHIFT LATHES INCLUDE . . .

types:	Engine, toolroom, raised head, tracer models (10″, 12½″, 15″, 18″, 21½″, 26″)
horsepower:	3 to 10
swings over bed:	11½″ to 35″
swings over cross slide:	6¾″ to 27¾″
bed lengths:	24″ to 216″
speed ranges:	11 to 3000 RPM
feed ranges:	.0009″ to .1224″
thread ranges:	1½ to 368 TPI

Priced in the light duty class . . . Hydrashift lathes provide the potential to handle a much wider range of work.

CINCINNATI

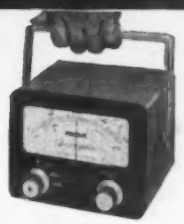
hydrashift speed shifting

Pre-selective speed shifting keeps the machine cutting more of the time—avoids waste motion and reduces operator fatigue. To change spindle speeds, the operator merely rotates the direct-reading speed control dial to the desired RPM—pre-selects his next speed *while the lathe is taking a cut!*

To shift speeds, the operator simply lowers the spindle start-stop lever to the brake position, then returns it to run position. The shifting is completed through hydraulic power.

Call your Cincinnati Lathe and Tool distributor for complete information. Or write Cincinnati Lathe and Tool Co., subsidiary of The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

LOW COST PORTABLE ELECTRONIC GAGING UNIT



Now more compact, more versatile, easier to use . . .

Feather-light touch Extremely low contact pressure — less than 2.5 grams — so light you can gage dependably to high accuracies using test set stands or even more conveniently, the new, low cost wide range height stand illustrated.

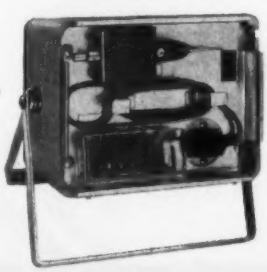
New Contact Tip Design New tip profile permits accurate measurements, without applying correction factors, even with finger at 20° angle to work.

Faster Zero-Setting Two-speed knob provides both long range electrical zero adjustment (over .008″) and fine setting. Each Electro-probe has two ranges (±.002″ and ±.001″ for one model and ±.001″ and ±.0002″ for the other). Other magnifications available. Scales are correlated; zero setting will not change when switching magnification.

Battery Life Quadrupled New transistor amplifier design gets over 1200 hours life from mercury cell battery (up to 2 years normal use). Can also be operated from pen size mercury cells or regular carbon type batteries. For continuous use, a battery eliminator can be furnished for 115 volt operation.

Improved Meter Visibility Adjustable legs, which double as carrying handles, permit placing meter at any angle for best visibility. The fine line graduations and hair-line pointer provide easy, precise readings.

Completely self-contained Rugged meter housing contains all amplifier components (transistors and printed circuit card) so unit can be mounted in a panel if desired. When used as portable unit, gage head can be removed and mounted without disturbing plug connection, and back cover replaced while head is in use. Small plastic box within housing contains holding and mounting accessories.



Rear view with cover off.

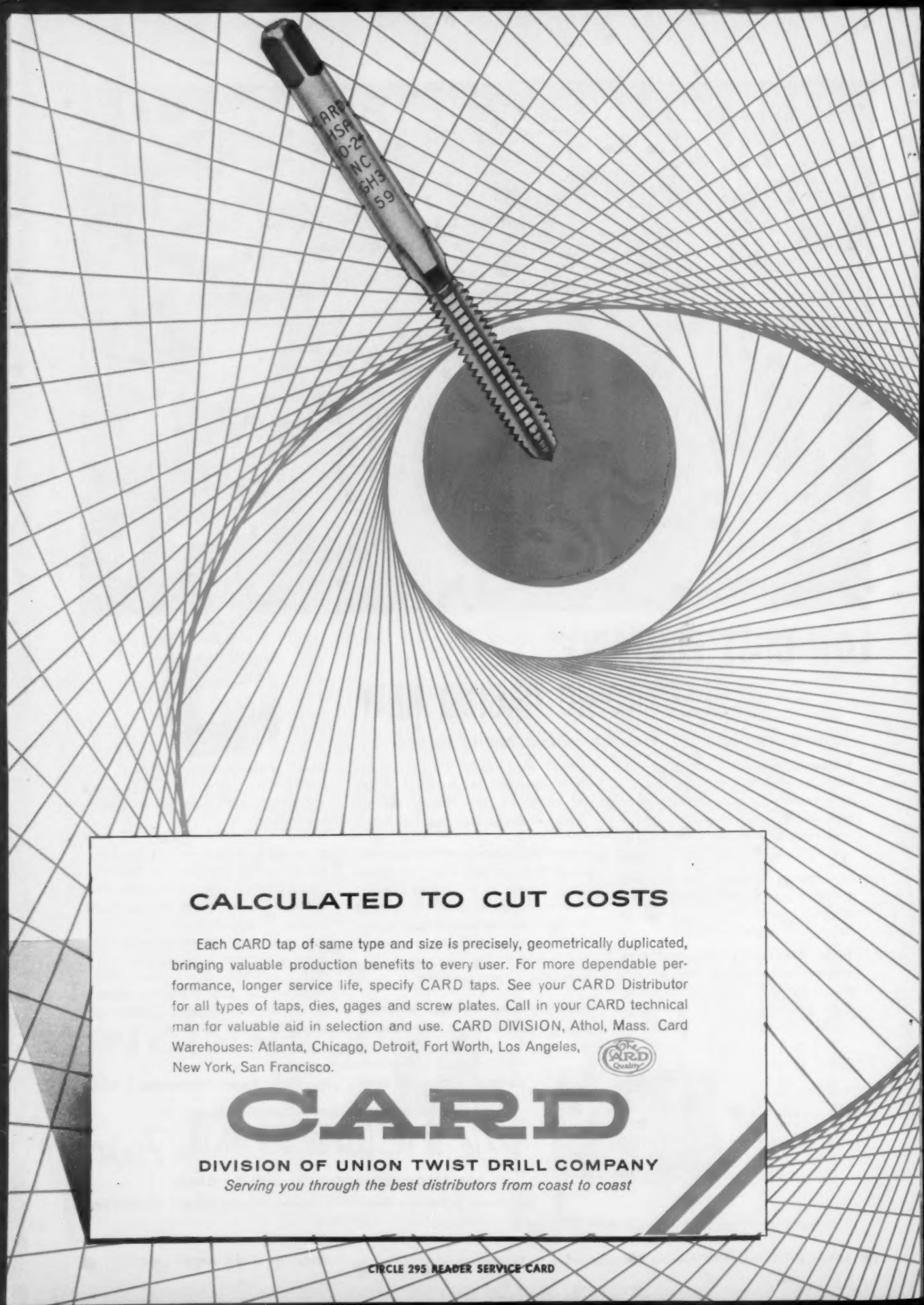
For demonstration or brochure, write

FEDERAL PRODUCTS CORP., 11211 Eddy Street, Providence 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



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Each CARD tap of same type and size is precisely, geometrically duplicated, bringing valuable production benefits to every user. For more dependable performance, longer service life, specify CARD taps. See your CARD Distributor for all types of taps, dies, gages and screw plates. Call in your CARD technical man for valuable aid in selection and use. CARD DIVISION, Athol, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

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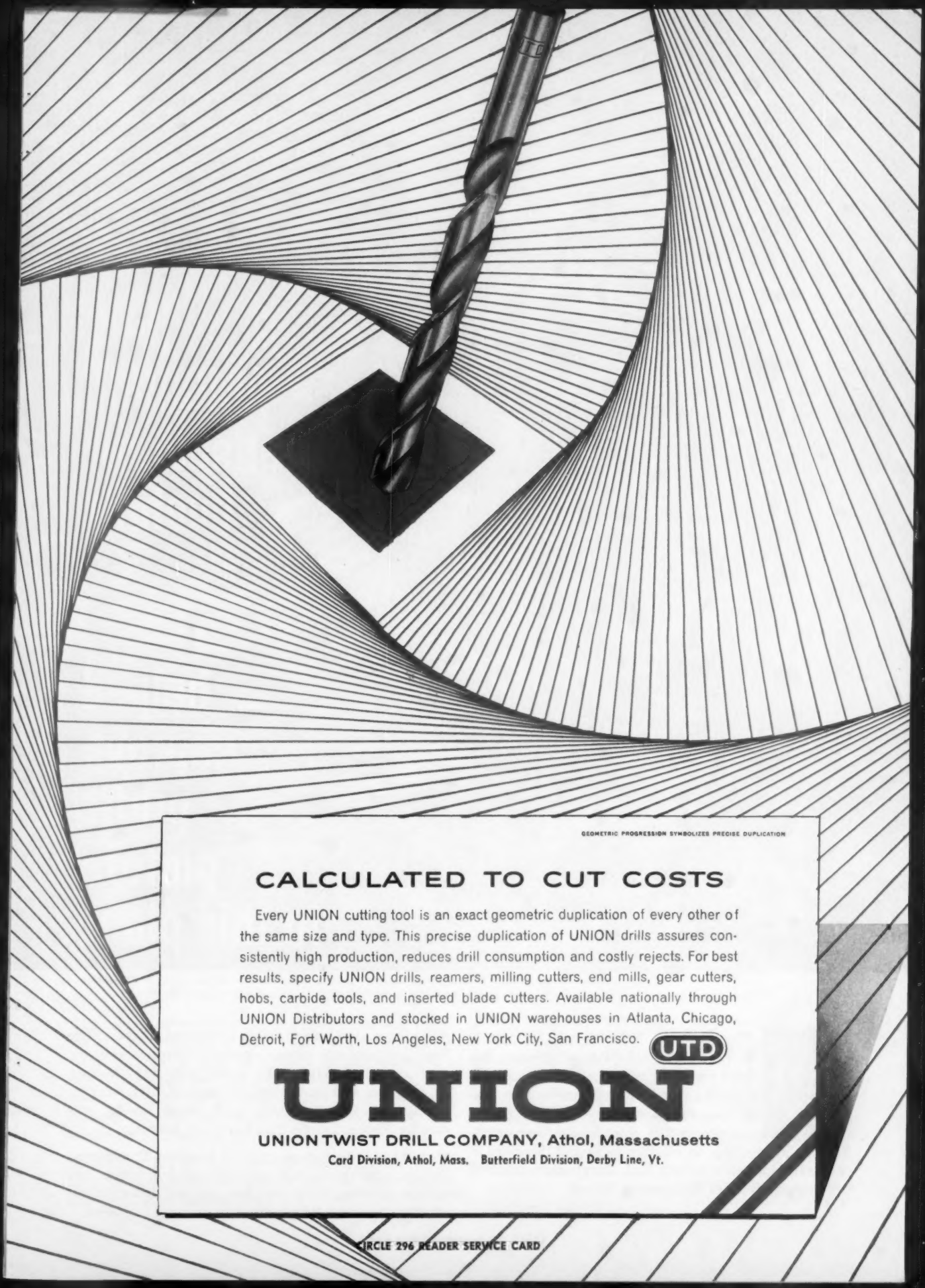
DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 295 READER SERVICE CARD



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Every UNION cutting tool is an exact geometric duplication of every other of the same size and type. This precise duplication of UNION drills assures consistently high production, reduces drill consumption and costly rejects. For best results, specify UNION drills, reamers, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, San Francisco.

UTD

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Card Division, Athol, Mass. Butterfield Division, Derby Line, Vt.

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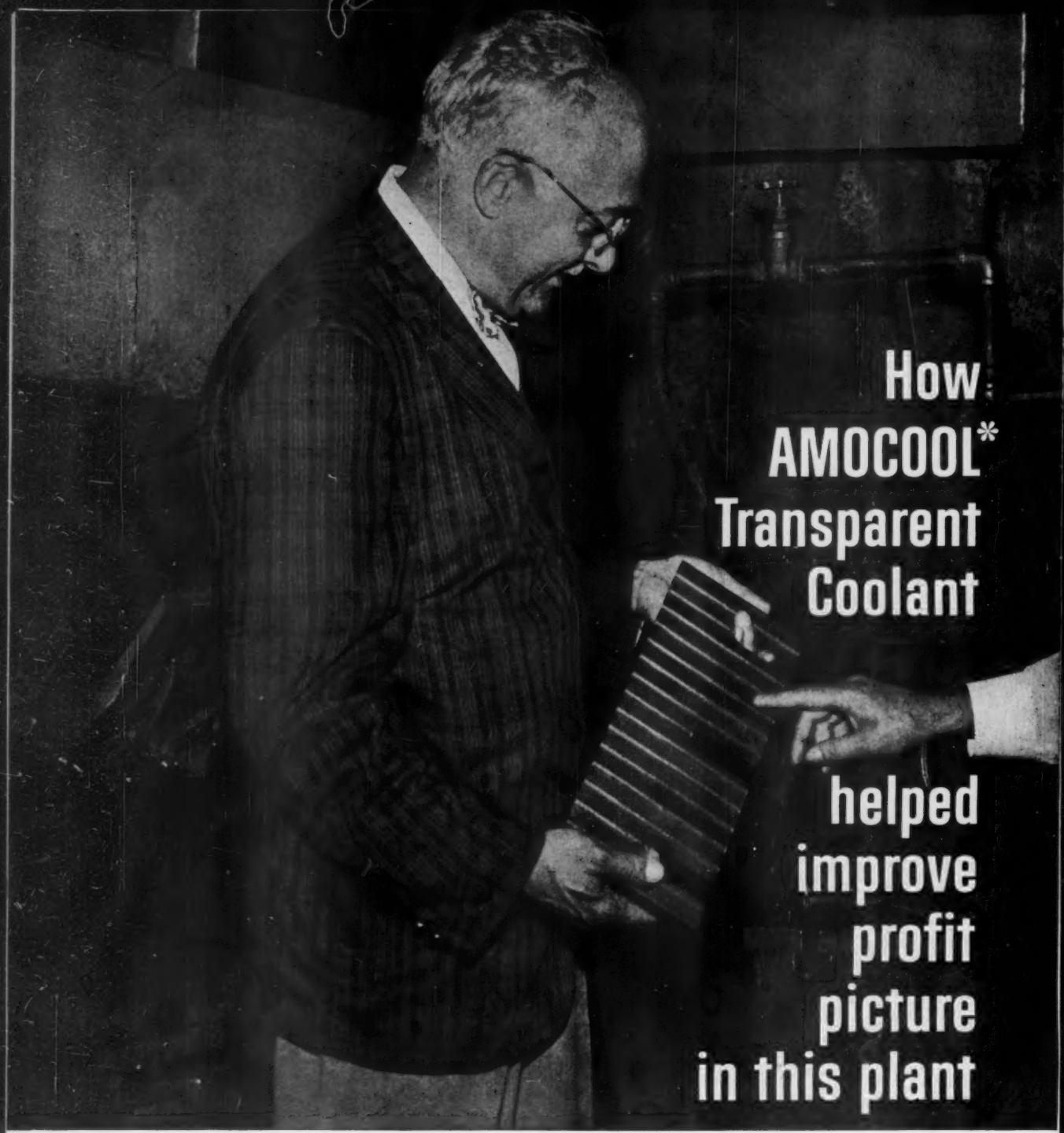


How AMOCOOL* Transparent Coolant helped improve profit picture in this plant

*Trademark

BY PAUL E. "PAPPY" STRATTON

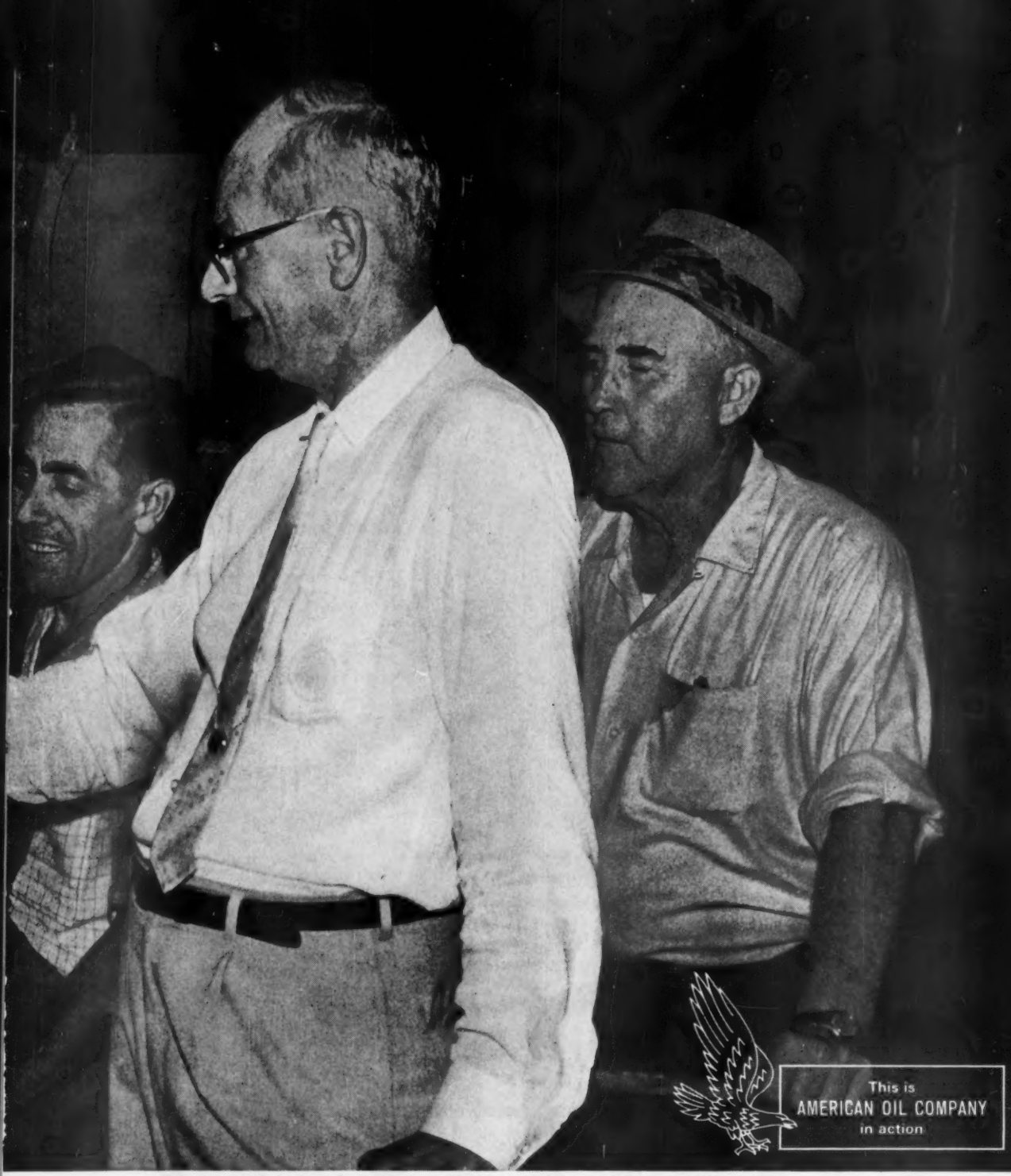
About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been working for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.

• • •

By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.

CIRCLE 297 READER SERVICE CARD



Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

* * *

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

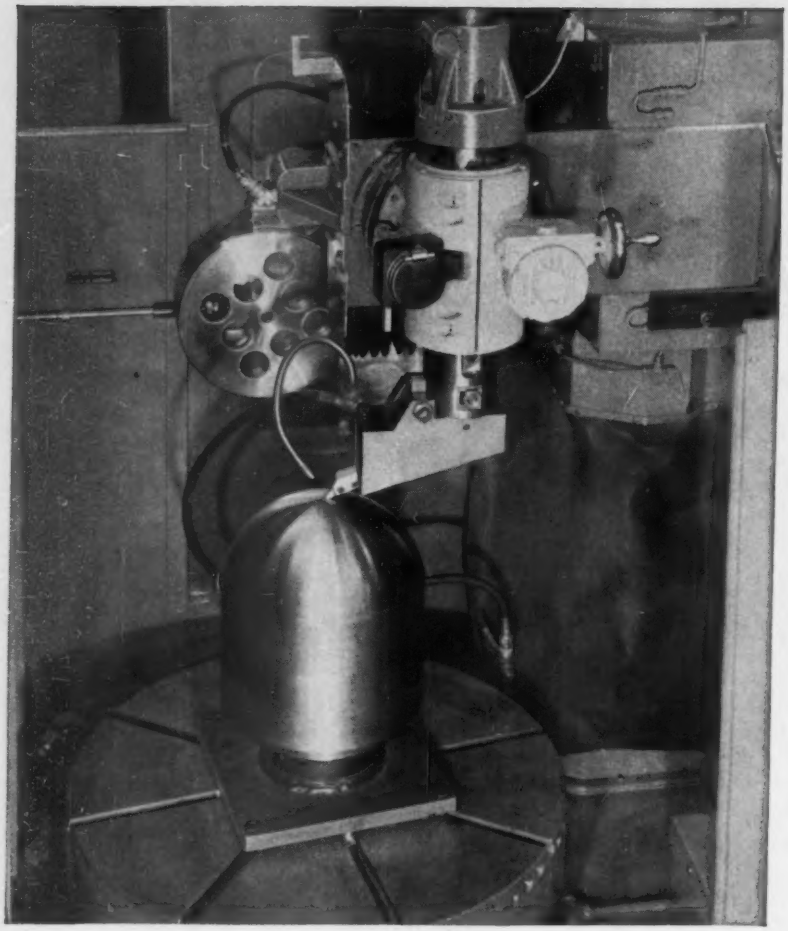
Quick facts about
AMOCOOL
Transparent Coolant

- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant.
- Odorless

AMERICAN

AMERICAN OIL COMPANY
910 South Michigan Avenue
Chicago 80, Illinois

CIRCLE 298 READER SERVICE CARD



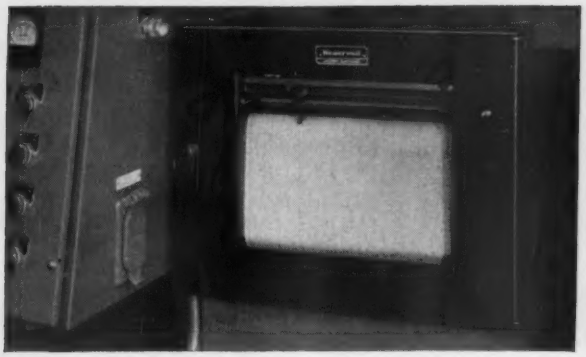
Super-precise turning, boring and grinding machine—A Frauenthal FIRST!

Countdown on contour turning accuracy...

.000150"

GUARANTEED

...even on 30" diameter work pieces!



The new Frauenthal electrohydraulic tracer control incorporates super-precise recording facilities. Recorded are the accuracy of the follower to the tracer template and the machine slides.

This versatile 900 Series machine has a 30″-diameter table with maximum swing of 36″. Maximum vertical slide travel — 32″; maximum vertical travel on manual turret slide — 3″.

The custom-built 900 Series achieves critical contour turning accuracies not available in similar machines. The precision-guaranteed 900 Series will hold a tolerance of ± .000150″ on contoured surfaces, with tolerances as close as ± 100 millionths possible on straight work pieces.

The 900 Series utilizes vertical design to eliminate the deflection normally encountered when unsupported parts are machined in a horizontal position.

Frauenthal's ultramodern electrohydraulic tracer system affords a new high degree of control reliability. Completely transistorized for compactness, it guides the vertical and horizontal travel simultaneously through 360° of motion. Any variation from true contour path is immediately indicated on a continuous recorder which also gives a permanent record of contour turning accuracy.

A numerical control for continuous path or point-to-point positioning is also available.

Enjoying unusual versatility, the new turning and boring unit anticipates machining needs far into the future. The machine will easily adapt to conventional grinding, turning, boring, milling, facing and polishing.

You can bring your most difficult machining problems to Frauenthal with complete confidence. Contact Frauenthal now.

Versatility of vertical machine design cuts floor-to-floor time • Two-axis tracer system holds stock removal constant per revolution regardless of stylus location on the contour • Cast work table with tee slots is ground flat to surface-plate accuracy to insure precise setup, measuring and installation of fixtures • Exceptionally efficient water-type heat exchanger and variable temperature control regulate the hydraulic system temperature within ± 1° to hold oil viscosity and maintain accurate tracing • Automatic force-feed lubrication • Unit can also be equipped for grinding.

Designed and built in the U.S.A.

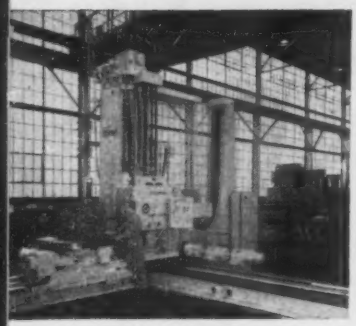
Frauenthal

DIVISION

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U.S.A.

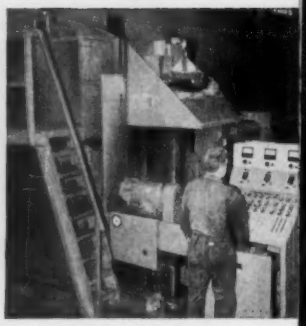
ANOTHER REASON TO SPECIFY **GENERAL ELECTRIC** NUMERICAL CONTROL



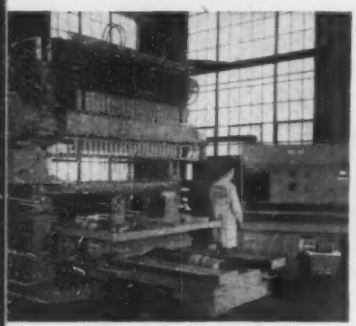
Cincinnati Gilbert Floor-type Horizontal Boring Mach., G-E Mark II NPC

Edlund Edlund-Matic (TM) Drilling and Tapping Machine, General Electric Mark II NPC

LeBlond Tape Turn Lathe, controlled by G-E Mark Century Numerical Contouring Control

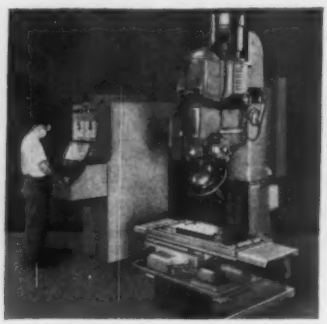


Hill Beam Drilling Machine, General Electric Mark IV NPC



Moline Tube Sheet Drilling Machine, General Electric Mark II NPC

Fosdick Fosmatic Turret Drill with Automatic Depth Control, General Electric Mark II NPC



Brown & Sharpe Turr-E-Tape Six-spindle Turret Drilling Machine, G-E Mark II NPC

Wiedemann Turret Punch Press, General Electric Mark II NPC

Selected by 50 machine-tool builders,

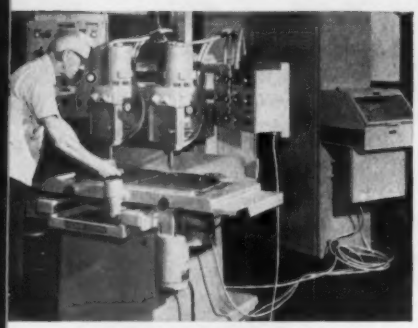
A double vote of confidence for General Electric's unmatched experience in designing, building, and applying numerical controls is evidenced by . . . the more than 50 builders who put them on the machines they sell . . . and, the over 500 American applications where they daily prove their outstanding performance on a variety of drilling, milling, punching, turning, and boring machines.

Many builders have used G-E automatic machine control since General Electric introduced electronic tracer control in 1943. Others selected G-E control based on the Company's pioneering work to develop the first magnetic tape contouring control in 1947. And many more turned to G.E. when the first building-block "packaged" positioning control—

CIRCLE 301 READER SERVICE CARD

NUMERICAL CONTROL
FOR AUTOMATION

American Tool Travelling 19-inch Column Openside Boring and Drilling Machine, General Electric Mark II NPC



Leland Gifford Two-head Printed Circuit Board Machine, General Electric Mark II Numerical Positioning Control

TODAY'S GENERAL ELECTRIC NUMERICAL CONTROL LINE features new Mark Century Numerical Positioning and Contouring Control (rear) and job-proved Mark Series Numerical Positioning Control for two to five motions (front).

proved in 500 metalworking applications

the Mark Series—was introduced in 1957. Its on-the-job record brought selection on 26 new machines exhibited at last year's Machine Tool Exposition.

And the current outlook is even brighter. New G-E Mark Century Numerical Control—utilizing solid-state circuitry—makes possible economical precision contouring with punched-tape input.

There are additional reasons to specify G-E numerical control: a full line to select from; nationwide service to minimize downtime; convenient time payment plan; and more that your machine tool builder or G-E Sales Engineer can tell you about. Or, write for descriptive bulletins to General Electric Company, Schenectady, New York. *Specialty Control Dept., Waynesboro, Virginia.* 795-13

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GENERAL ELECTRIC

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Steel

Strong, Modern, Dependable

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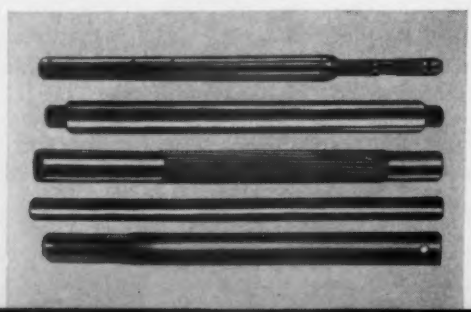
TRIM COLD FINISHED BAR COSTS. Republic's CENTURY SERIES offers five grades of high-strength, stress-relieved, cold finished bars, each with a minimum yield strength of 100,000 psi. For highly machined parts, use C-1144. Moderately machined parts—C-1140 or C-1151. For parts where machinability is a minor factor—C-1050 or C-1045. Send for complete data.



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World's Largest Producer of SPECIALTY WELDED TUBING

Challenge us to come up with a solution to your toughest tubing applications.

We will produce the best possible answer drawn from Republic's full line of quality welded steel tubing and more than 50 years of applied engineering experience.

This claim is made with confidence. Our customers regularly hand us their tubing problems, and the results have provided mutual satisfaction.

Manufactured at the Steel and Tubes Division, Republic Tubing is welded by the ELECTRUNITE® process—a continuous electric weld method which unites the wall under pressure without foreign or extra metal. Among other advantages, this process assures uniformity of wall thickness, strength, ductility, and concentricity.

Republic, the pioneer in this improved welding process, was also the first to provide a nondestructive electronic production method of testing tubing used for critical pressure applications. This is known to the trade as FARROWTEST®.

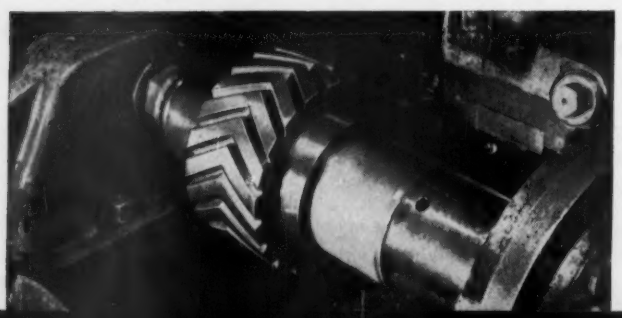
Next time you have a tubing application or problem, take advantage of Republic's prompt delivery, engineering services, and complete range of carbon and stainless steels for mechanical, structural, and pressure uses.

Call your nearest Steel and Tubes representative or contact us direct.

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

FOR ADDED MACHINABILITY, consider Republic Cold Drawn Leaded Alloy Steels. Leading producers of gears use Republic Leaded Alloy Steel in the manufacture of heavy-duty herringbone gears. Addition of lead increases machinability as much as 25%. Heat treating assures adequate hardness and toughness. Cost-reducing Republic Alloys are available in almost every standard analysis and many specials. Mail the coupon for information.



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STAINLESS STEEL

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CARBON STEEL

Pressure Tubing

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- ☐ Hot Rolled Tubes
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Cut out and send this check list for descriptive literature on Republic Tubing and Pipe applicable to your products.

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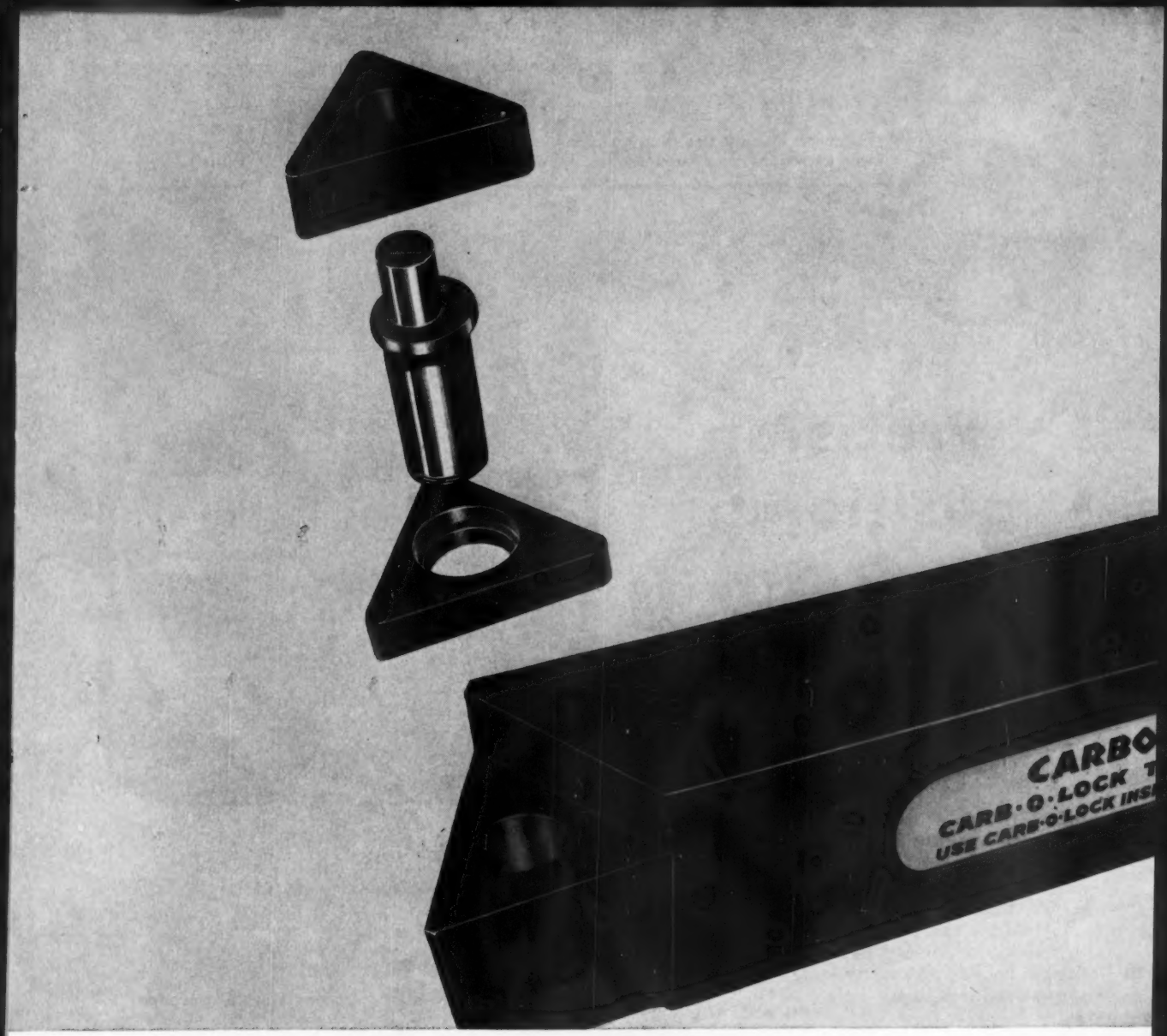
CIRCLE 304 READER SERVICE CARD

How to cut your disposable-tooling costs by 30 per cent at no sacrifice in quality or output. (Answer is on the next page.)



With the new Carb-O-Lock toolholder-insert combination. The single most important advance in the whole history of metal-cutting.

Save 30 per cent when you buy it. Save 40 per cent when you use it.

These are minimums. Users of the Carboloy Carb-O-Lock toolholder-insert combination have reported savings many times higher. Why?

Simple. The Carb-O-Lock design is simple. Using a cam-action locking principle, the Carb-O-Lock has just three parts (not including insert). Insert changing and indexing is a breeze; parts inventories can be held to absolute minimums. Streamlined design lets you bring the toolholder closer to your work. And less overhang means less vibration, less insert chipping and breaking.

Plus: the Carb-O-Lock gives you proven performance. A major diesel engine manufacturer discovered Carb-O-Lock allowed nearly triple the feed, eliminating two machines. A locomotive and car equipment company found Carb-O-Lock's simple, rugged design reduced time for tool changes and permitted maximum horsepower utilization.*

Carb-O-Lock inserts are available now in Grade 883 for machining cast iron, as well as many operations on the following materials: high-temperature alloys, type 300 stainless steel, brass, bronze.

So start your savings program today. Phone your Authorized Carboloy Distributor and order your Carb-O-Lock toolholder-insert combination. Save 30 per cent. And more.

Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Road, Detroit 32, Michigan.

**Case histories available on request*

CARBOLOY
CEMENTED CARBIDES

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GENERAL ELECTRIC

CARBOLOY CEMENTED CARBIDE BLANKS AND DISPOSABLE INSERTS
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CIRCLE 306 READER SERVICE CARD

Precision positioning to .0001"

The new VERNAC direct reading optical measuring instrument indicates longitudinal, lateral or vertical position of the table of any machine without benefit of mechanical connections. It can be incorporated in new equipment or tools already in service.

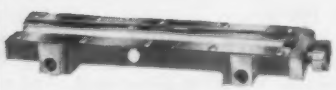
HOW IT OPERATES: Readings from a precision scale, affixed to a machine tool, are transmitted through a 22-power lens system onto an illuminated, highly visible, direct-reading dial. Readings are in .025" intervals. A double spiral reticle on the dial provides the final measurement refinement to .0001" without interpolation. All readings are complete within the dial area eliminating reference to an outside pointer.

FREE BROCHURE will give you all the facts. Write for your copy today.

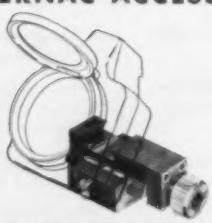
- **Repeatability to less than .0001"**
- **All readings on one dial**
- **No moving parts**
- **Accuracy unrelated to wear of table screw**
- **No setup—eliminates gage blocks, end rods**

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

VERNAC ACCESSORIES

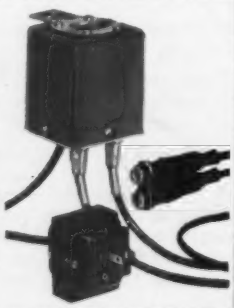


VERNAC SCALE ZERO SHIFTER
moves only the VERNAC Scale over 1" range to nearest convenient reference point. Adjusting knob available on either end of Scale.



VERNAC READER ZERO SHIFTER
moves only the VERNAC Reader over a 1" range. Adjusting knob available on either side.

VERNAC INTERVAL TIMER
turns off lights in instruments automatically after 3-minute interval. Controls 1, 2 or 3 instruments. Eliminates lights being left on accidentally...fewer bulb changes ...less down time...reduced maintenance costs. Metal-encased Timer has bracket for easy attachment.



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3200 West Carroll Avenue, Chicago 24, Illinois • VAn Buren 6-3030
Manufacturers and designers of precision optics for scientific equipment since 1926

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● Precisely the point...

When you buy new tools or rebuild old ones

START UP FRONT

- Precisely the point where the tool does its work.
- Precisely the point where profits are made and lost.
- Precisely the point where the accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

This is precisely the point, start up front with Jacobs.

The Albrecht Chuck is the world's finest heavy duty keyless drill chuck. It is ideal for use on high speed, sensitive drilling machines, for close tolerance work on milling machines or jig borers.

- All working parts ground and hardened
- Every piece interchangeable
- Hand locking, self tightening
- Minimum runout, exacting accuracy
- No springs . . . no key

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Your industrial supply distributor knows your business. He is always ready to fill your needs quickly and economically. When you need chucks you can depend on this industrial team—Jacobs and your Jacobs industrial supply distributor.

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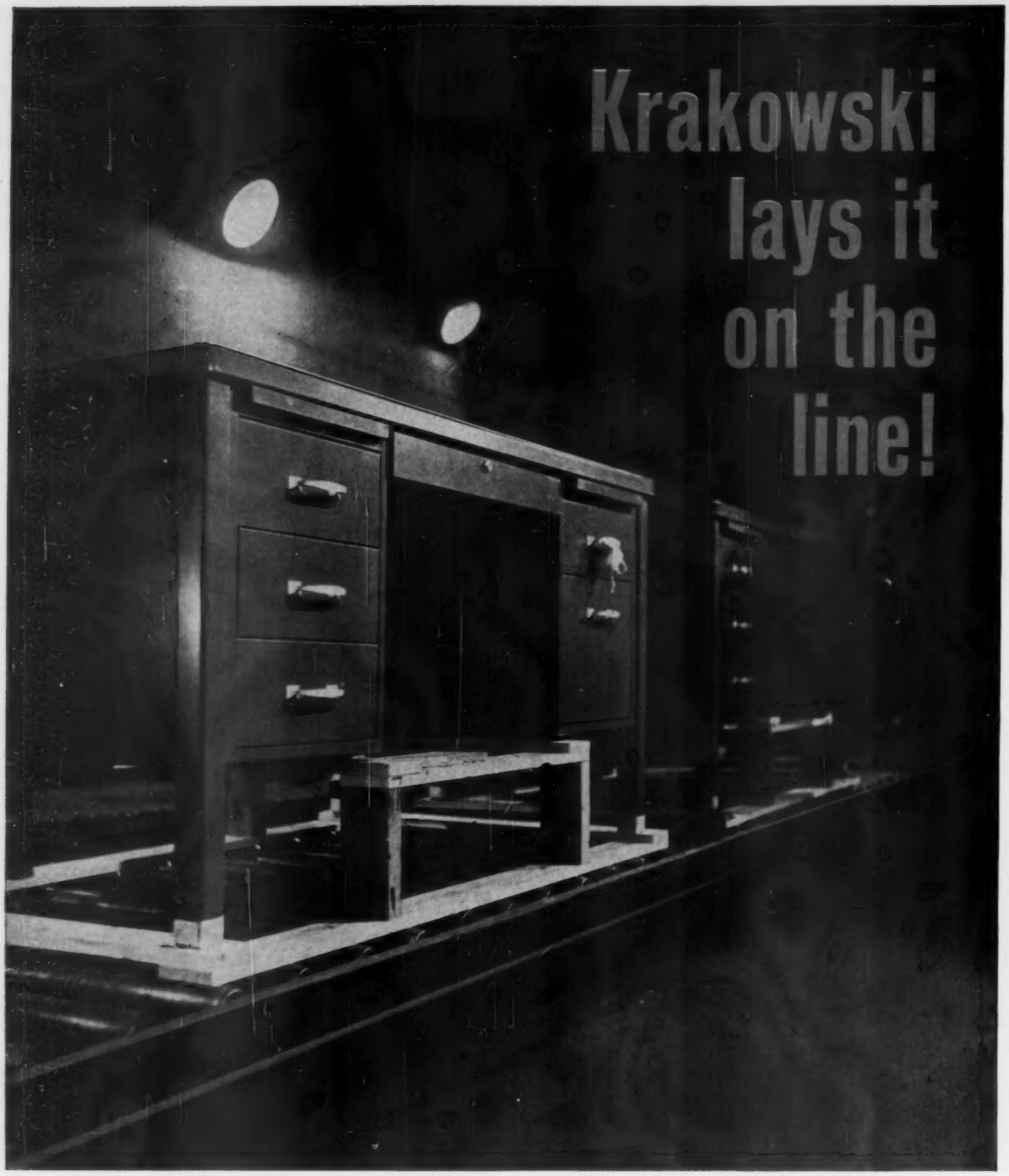
INDUSTRIAL DISTRIBUTORS — SERVING INDUSTRY'S ECONOMICALITY — THE RIGHT HAND OF PRODUCTION

THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT



Lou Krakowski, General Superintendent of the Harrison Sheet Steel Company, is a guy who makes no bones about what he wants. It's service! And, for twenty years, he has been getting what he considers the best . . . Cities Service.

Turning out, among many other things, 125 steel desks a day, he wants complete and dependable lubrication service. One of the many Cities Service products he uses to get this job done is Trojan H-2 grease. For general greasing on all equipment, multi-purpose Trojan H grease has a wide range of application. And, because of the variety of jobs Trojan H grease does, it reduces his necessary lubrication stocks.

If you have to *get it on the line* . . . call your nearest Cities Service office . . . or write Cities Service Oil Company, 60 Wall Street, New York 5, N. Y.

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QUALITY PETROLEUM PRODUCTS

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Details about Jones & Lamson Thread & Form Grinders Also . . . a New Line of Compact, Precision Machines

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MODEL E-2 AUTOMATIC FORM GRINDERS

The Jones & Lamson Model E-2 Automatic Form Grinder is specifically designed for precise, high production, plunge grinding on shaft work up to 31″ in length. It is also adaptable for other types of between-centers work, as well as chucking work and jobs requiring external, shoe-type support.

These Important Features Provide PRECISION FORM GRINDING AT HIGH PRODUCTION RATES

COMPLETELY AUTOMATIC CYCLE . . . High-speed approach, variable wheel feed, spark out, and withdrawal are positively controlled through simple cam action. This ensures a constant and uniform machine cycle.

AUTOMATIC POSITIVE SIZE CONTROL . . . Wheel-slide held against positive stop with uniform hydraulic pressure.

AUTOMATIC TRUING DEVICE with CONTROLLED DRESSING . . . Once per piece, or once per predetermined number of pieces.

CRUSH WHEEL OR DIAMOND TRUING OR PERPETUAL FORM CONTROL (PFC — see center spread)

AUTOMATIC OR MANUAL HANDLING

COMPLETELY PACKAGED HEADSTOCK . . . Equipped with a constant speed A.C. motor. Work speeds range from 50 to 1500 R.P.M. Fast cycling (starting and stopping of the work spindle is done by means of an electric clutch and brake).

ADJUSTABLE WHEEL SPINDLE . . . Fast centerline adjustments for wheels varying from ⅜″ to 2″. Wheel flanges are also adjustable to accommodate wheel widths from ⅜″ to 2″.

DESIGNED FOR EASY MAINTENANCE . . . all hoods and guards are instantly removable. Internal machine components are readily accessible. For instance, the entire wheel-slide transmission can be taken out of the machine by simple removal of seven bolts.

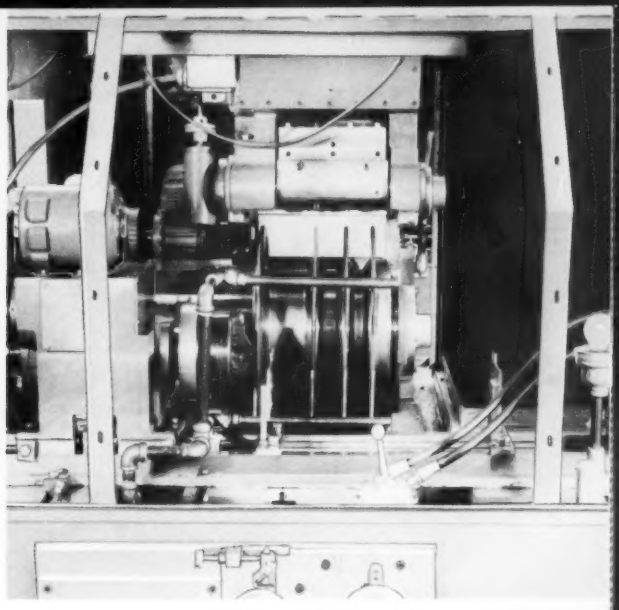
WHEEL-SLIDE HAS HARDENED AND GROUND WAYS . . . with three-point suspension system mounted on straight roller bearings.

EASY TO OPERATE . . . with features such as push-button control for automatic cycling, including automatic counter control for wheel truing.

All controls for operation and set up are located at the front of the machine. Free sliding doors to work area operate on roller bearings. There's plenty of room for loading and unloading—or for automatic handling.

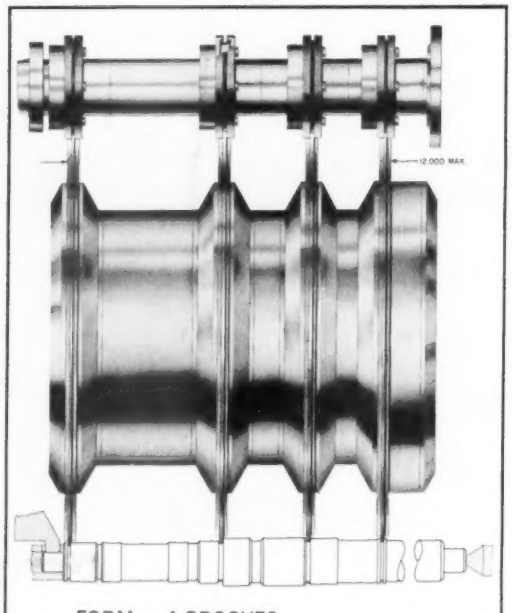
NEW

MODEL E-3 PROVIDES PERPETUAL FORM CONTROL FOR 12" WHEEL SPREAD



This new Model E-3 Form Grinder is specifically designed for precise, high production plunge grinding of widely spaced grooves.

Vertical design of the J & L Perpetual Form Control Truing Device, allows for a full 12" of wheel spread. Grooves up to 12" apart may be plunge-ground in a single pass.



FORM — 4 GROOVES
TIME OUT FOR DRESSING — 0
PRODUCTION — 125 PCS. PER HOUR

SPECIFICATIONS

J & L Model E-2 & E-3 Form Grinders

	MODEL E-2	MODEL E-3
Max. dia. of ork ground with 20" dia. wheel	8"	8"
Headstock spindle-speed range	50-1500 R.P.M.	50-1500 R.P.M.
Max. dia. of swing over table	13"	13"
Max. length between centers	31"	31"
Platen — may be swiveled up to	15°	15°
Grinding wheel motor	5 to 25 H.P.	5 to 25 H.P.
Grinding wheel dia. 20" and hole size	10"	10"
Hand infeed per graduation	.0001" on dia.	.0001" on dia.
Max. spread of multiple-spaced grinding wheels	5"	12"

If the J & L Grinding insert is missing, write JONES & LAMSON, 502 Clinton St., Springfield, Vermont, for your copy.

J & L MODEL F AUTOMATIC THREAD GRINDING MACHINE

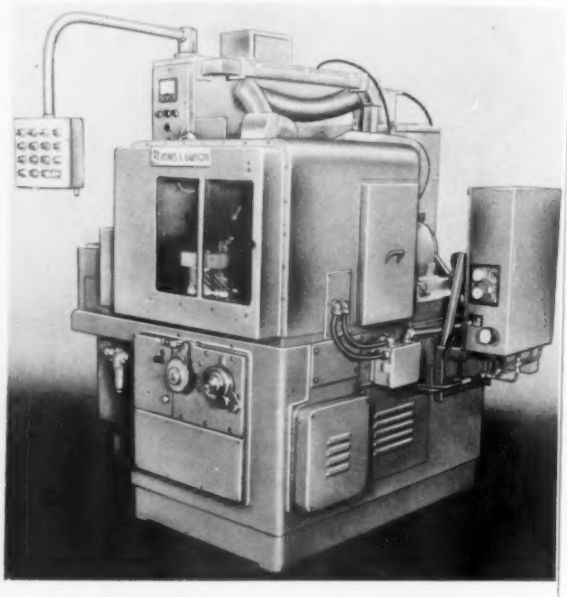
This machine is automatic in all of its functions. It will grind in both directions, or in one direction with automatic wheel withdrawal and rapid traverse. Pitch changes are accomplished through individual lead screws for each pitch, or hand of thread.

A wide range of work and wheel speeds are available. Work speeds range from 30 to 720 R.P.M. Rheostat control provides an infinite number of grinding wheel speeds between 1000 and 2600 R.P.M. This allows for quick selection of the most efficient speeds for all types of Vitrified and Resinoid Bonded grinding wheels.

Machine accuracy is guaranteed to grind threads within the following tolerances: pitch diameter to within .0005″ in regular production. Thread angle ±5′ on the half angle. Lead ±.0002″ per inch.

"CRISS-CROSS" GRINDING

Grinding time can be further reduced by 25%, when two-way grinding with two cuts. Here's how. Two wheel speeds and two work speeds can be provided automatically for each machining cycle. Work may be rough ground at a high wheel speed and a low work speed. Finish passes may then follow automatically with a lower wheel speed and at a work speed double that used for the roughing pass. This feature may also be applied when using one-way grinding.

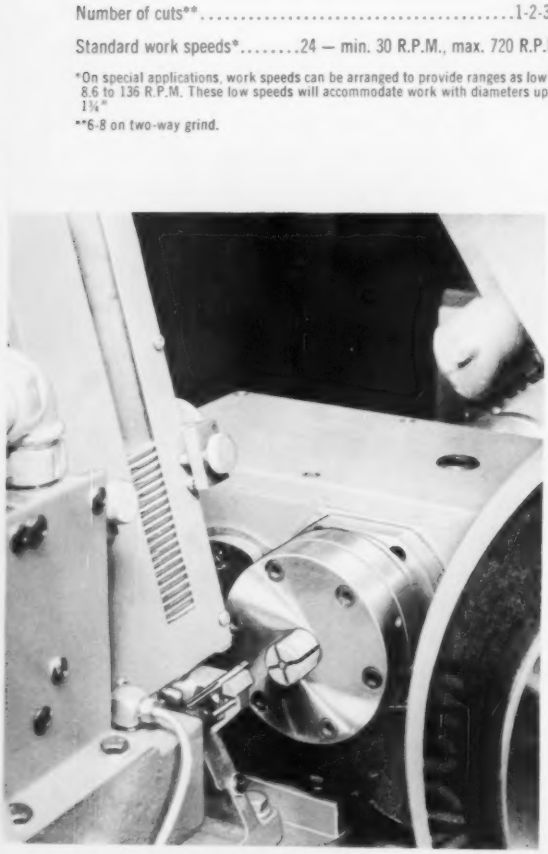


SPECIFICATIONS — Model F

Max. thread dia.	¾″
Max. work length	6.900″
Max. dia. swing over table	10″
Max. thread length	3″
Number of cuts**	1-2-3-4
Standard work speeds*	24 — min. 30 R.P.M., max. 720 R.P.M.

*On special applications, work speeds can be arranged to provide ranges as low as 8.6 to 136 R.P.M. These low speeds will accommodate work with diameters up to 1¼″

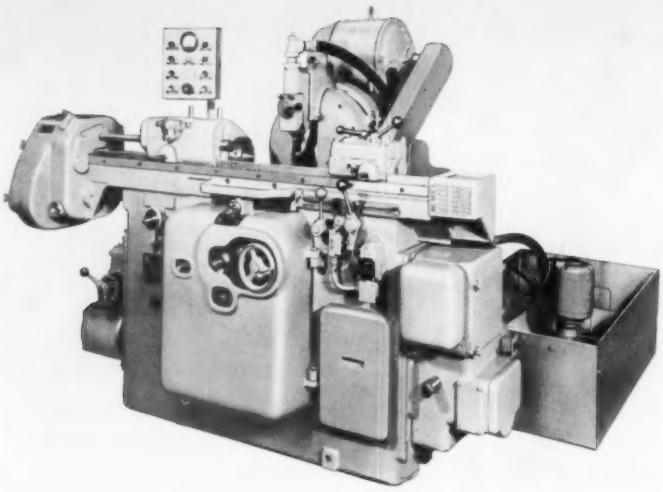
**6-8 on two-way grind.



AUTOMATIC HANDLING On MODEL F AUTOMATIC THREAD GRINDER

Here is automatic handling as applied to the Model F in a tap grinding operation. Magazines for seven different sizes of taps ranging from #6 to ⅜″ are applied to the machine. The tap blanks are then fed to the grinding position, ground, and unloaded — automatically. A warning light, or horn, tells the operator when to change the empty magazine for a full one.

Production of up to 120 pieces per hour is possible.



AUTOMATIC THREAD GRINDERS

6"x15"
6"x36"
12"x45"

6" x 36"

MODEL TG-615. The 6" x 15" Automatic Thread Grinder is used for high-production thread grinding with multi-rib wheels, on relatively small, light work.

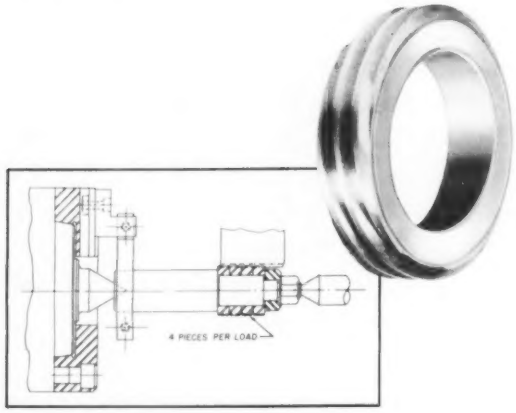
MODELS TG-636 and TG-1245. These machines are extremely versatile and are used on long or short-run jobs on taps, studs, gages, hobs, worms, spindles and a great variety of precision threaded parts. They are also used extensively for various kinds of form grinding. Single-rib, three-rib or multi-rib wheels can be used. They are fully automatic in the work cycle. Automatic dressing of the wheel, automatic sizing, automatic compensation for the amount dressed off the wheel, are some of the features that make these machines the finest of their kind for high precision thread grinding in the tool room or in the production line.

SPECIFICATIONS

	TG-615	TG-636		TG-1245	
	**	*	**	*	**
Max. thread dia.	6"	6½"	6½"	12"	12"
Max. thread length	2"	12"	2"	18"	2"
Max. work diameter	7½"	7½"	7½"	21"	21"
Max. work length	30"	36"	31"	45"	40"
Max. distance from end of thread to headstock center	14¾"	24"	19"	33"	28"

*Single-Rib Wheel.
**Full Multi-rib Wheel.

Any of these machines can be arranged for plunge grinding single or multiple grooves or contours. Multi-ribbed wheels, either diamond or crush dressed, are adaptable for all models.



SPEEDOMETER DRIVE GEARS

These four-start worms are ground, four at a time, in a single pass from the solid. A multi-ribbed wheel is crush-dressed every 48 pieces (twelve arbor loads). The finish on these parts and the rate of production exceed those possible by any other methods.

210 pieces per hour, floor-to-floor

SPECIFICATIONS

Diameter	1.93"
Pitch	Approx. 6
Form	Worm
Thread	4-Start
Lead	.6797"
Helix Angle	6° 37'
Thread Length	1⅛"
Stock removed	.089"

If the J & L Grinding insert is missing, write JONES & LAMSON, 502 Clinton St., Springfield, Vermont, for your copy.

Simultaneous Grinding a

This process is made possible by PFC (perpetual form control) truing devices manufactured by Jones & Lamson and CDP (cemented diamond particle cutters) produced by the Koebel Diamond Tool Company.

It provides continuous automatic control of accuracy for grinding wheels and grinding wheel action.

This revolutionary development permits you to grind many applications that otherwise would not be considered as economically sound for a grinding operation. It also allows one to materially improve upon a wide variety of operations performed by other machining methods or grinding approaches. For instance, automatic handling on grinding jobs becomes a much simpler and more economical process when there is no "time out — for wheel truing".

Depending upon the nature of the job, the wheel truing can be done, either intermittently, or continuously. The frequency of truing is controlled by an electric counter which is set to a predetermined number of pieces. This number is determined by the various specifications and complexities of the operations.

Even when using an intermittent truing cycle, the actual wheel truing occurs simultaneously with the grinding operation. Therefore, whether you are grinding and truing continuously or intermittently — no time is lost for conditioning the wheel.

Life of the CDP cutters is phenomenal. It frequently ranges over several months and hundreds of thousands of pieces ground — without changing the cutters. On one installation the original cutters are still in use after grinding over six million pieces. Also, the versatility of this process permits the best use of either Resinoid or Vitrified bond wheels.

Figures 1, 2 and 3 on the opposite page illustrate typical examples of groove grinding operations employing the PFC plunge form truing device with assemblies comprised of standard and special CDP cutters. Figure 4 shows a thread grinding operation using the PFC multiform truing device. In this case the cutter is controlled by a former as it is traversed across the wheel. Truing may occur simultaneously with the thread grinding operation providing more than one grinding pass is taken.

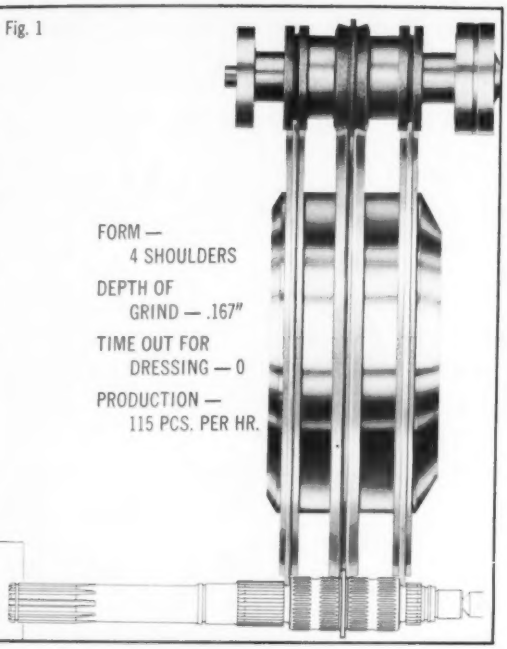
When equipped with the proper former, the PFC multi-form truing device may also be used for a wide variety of contours for form grinding applications. A single universal design cutter will accommodate a wide scope of threads and forms, or a specialized cutter may be provided for ultimate performance on long-run operations.

The multi-form technique is also adaptable for tolerance and finish requirements which are beyond the range of the plunge form method.

With any of the methods described, the amount trued off the wheel is automatically and accurately compensated for. Therefore, either manually operated or automated machines maintain part size to closer tolerances over a longer period of time than other methods where the dressing tool is more subject to wear. Due to negligible wear on the cutters over long operating periods, substantial savings are also made in inspection costs as only occasional spot checking is required.

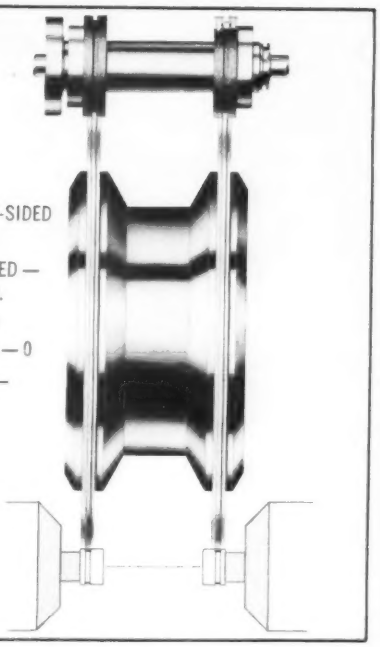
and Wheel Dressing

Fig. 1



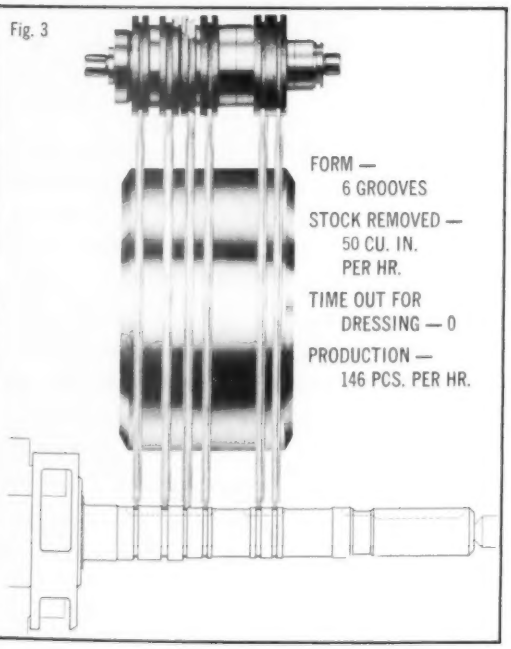
FORM —
4 SHOULDERS
DEPTH OF
GRIND — .167"
TIME OUT FOR
DRESSING — 0
PRODUCTION —
115 PCS. PER HR.

Fig. 2



FORM —
STRAIGHT-SIDED
GROOVE
STOCK REMOVED —
.040" ON R.
TIME OUT FOR
DRESSING — 0
PRODUCTION —
2,400 PCS.
PER HR.

Fig. 3



FORM —
6 GROOVES
STOCK REMOVED —
50 CU. IN.
PER HR.
TIME OUT FOR
DRESSING — 0
PRODUCTION —
146 PCS. PER HR.

Fig. 4

FORM — 60° THD.
8 T. P. I.
STOCK REMOVED —
.087" ON R.
TIME OUT FOR
DRESSING —
.04 MIN.
PRODUCTION —
31+ PCS. PER HR.

If the J & L Grinding insert is missing, write JONES & LAMSON, 502 Clinton St., Springfield, Vermont, for your copy.

NEW

MODEL 410 SEMI-AUTOMATIC THREAD GRINDER

High Precision
Compact Size
Low Priced

The J & L Model 410 is the first completely new thread grinding machine to be developed in many years. Here is a compact size thread grinder, priced accordingly, that provides *full size* capacity and exceptional accuracy.

ACCURACY is within ±5′ on the half angle; size control. 0005″ on pitch diameter; lead error ±.0002″ per inch. Here is how it's done:

High precision is designed for all sliding units using pre-loaded roll design for smooth accurate movements. Lead screw and infeed screw are precision ground. Direct line design of feed screw and stop for accurate size control. Precision work and wheel spindles are cartridge type, pre-loaded and lubricated for life. An inbuilt sine bar provides for long or short lead. A simple, accurate truing device dresses straight sided flanks from 5° to 45° and included angles of 10° to 90°.

COMPACTNESS The 50″ x 54″ floor space includes the machine, electrical panel, coolant tank & pump, plus storage for wheels & tools.

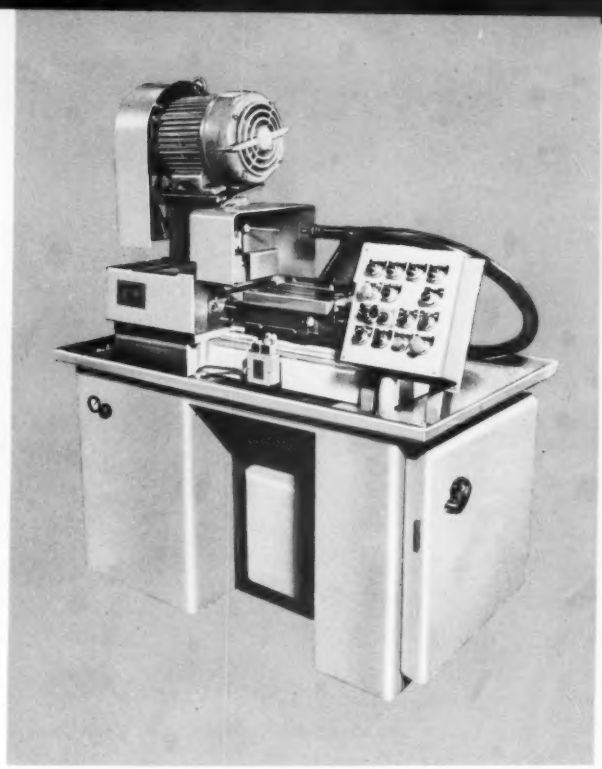
LOW PRICED For approximately $2.00 per hour for a 40 hour week, this machine can be leased on a 5 year J & L Profitivity Lease Plan. Includes: capacity for up to 4″ dia. work with 10″ of full thread length; variable speed work spindle; change gears and lead screw for 5 to 80 pitch threads; automatic truing device; all electric equipment — complete with motor and control panels; dresser infeed attachment; belts and pulleys; tailstock and headstock with centers; wheel adapters and two grinding wheels; plus a set of diamonds and driving dogs. This same machine can be purchased outright for under $11,000.

SPECIFICATIONS

Max. dia. of work	4″
Max. thread length	10″
Max. swing over table	4¾″
Work spindle speeds	2.5 to 120 R.P.M.
Grinding wheel speeds	2700 R.P.M
Max. helix angle	15°
Pitches available with standard set of change gears:	5, 6, 7, 8, 9, 10, 11, 11½, 12, 13, 14, 16, 18, 20, 24, 27, 28, 32, 36, 40, 44, 48, 56, 64, 72 and 80

NEW

PRECISION GUN DRILLING MACHINE FEATURES HIGH PRESSURE COOLANT DISTRIBUTION PLUS SPINDLE SPEEDS OF 15,500 RPM



Here for the first time is a machine which combines the major features necessary for successful gun drilling of very small holes. They are:

1. A *precision high speed spindle* capable of handling high pressure coolant flow.
2. *Accuracy* necessary to control size and straightness as well as excellent finish.
3. *Precise control* of constant, but *infinitely variable feed rates.*

The precision, pre-loaded ball bearing, cartridge-type spindle is specially designed to perform dual functions. It is arranged to handle standard shanks of all gun drills from ½″ dia. down to the smallest (.078″) at speeds up to 15,500 R.P.M. It is equipped with a rotary distributor for handling up to 12 gallons of coolant per minute and pressures up to 2,000 p.s.i. This combination of high speeds and coolant distribution at high pressure is a unique feature of the J & L Precision Gun Drilling Machine.

The machine bed is a rigid diamond-ribbed design, insulated from the base cabinet on a three-point mounting which dampens external vibrations.

The table is air-actuated with rapid traverse and feed controlled by a precision hydraulic check unit.

Performance will vary with material and conditions. However, when working with reasonable material, using proper gun drills in proper alignment, the machine is capable of producing parts to .0005″ in hole straightness up to 6″ in length. It will also hold diameter to .0002″ at a finish of 10 micro inches or better.

Penetration rates of 12″ per minute, or better, are not unusual.

SPECIFICATIONS

Max. length of hole	7½″
Stroke	7¾″ (max.)
Diameter of hole	max. ½″ — min. .078″
Variable or single speed drives for complete range of speeds	3500-15,500 R.P.M. 1750-7350 R.P.M. and 850-3675 R.P.M.
Feed rates	infinite
Floor space — without Coolant System	56″ x 34.5″
Floor Space — with Coolant System	56″ x 83.5″

If the J & L Grinding insert is missing, write JONES & LAMSON, 502 Clinton St., Springfield, Vermont, for your copy.

NEW MODEL 6 PRECISION BORING MACHINE

High precision . . . Compact size . . . Low priced

This extremely versatile new model is a highly accurate machine for precision boring, turning, and facing operations.

Accuracy is guaranteed to hold .0002″ tolerances on boring and turning operations (these machines are holding tolerances of .00005″ on some operations now being performed in the field).

Precision balance, rigidity, and infinite feed rates provide the basis for maintaining the best possible finish requirements.

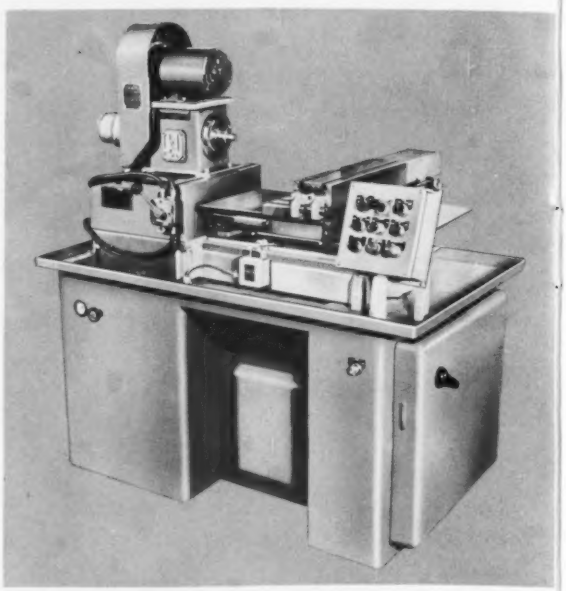
Various machine cycling combinations are available to the operator by merely setting a selector switch. These include: automatic table cycle, automatic table-and-cross-slide cycles, and completely manual operation.

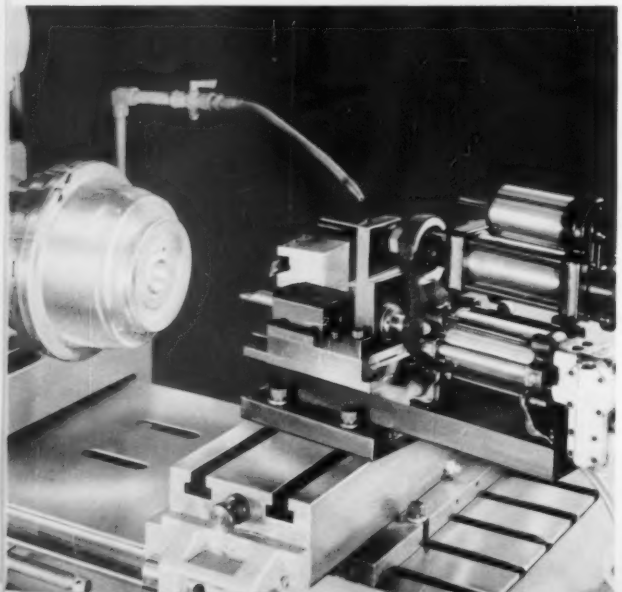
Set-ups are fast and simple All stops and feed adjustments are made from the front of the machine — without wrenches. Operation is even more simple. Just push one button.

Low priced For the wages of a part-time handy man, or about 95¢ an hour (figured at 160 working hours per month for 5 years) you can lease this precision machine with standard tooling arranged to handle most boring, turning and facing jobs with the capability of holding tolerances of .00005″. That's profitable precision for less than $1.00 per hour. Outright purchases make the investment even more attractive.

SPECIFICATIONS

Swing	10″ dia. (max.)
Stroke	7¾″ (max.)
Bore	3″ dia. (max.)
Speed range	900-3280 R.P.M. or 1500-6000 R.P.M.
Floor space	56″ x 34.5″





Machine V-Belt Groove and Bore Tapered Hole in one operation

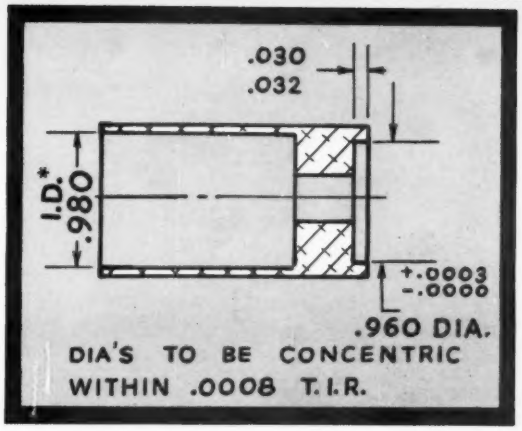
These pulley starter housings are gripped internally on an air operated chuck and located against a drive pin. The automatic cycle is as follows: the table moves to a stop position and the cross-slide feeds in to form a V-shaped groove. The cross-slide then backs out in rapid traverse and an auxiliary air hydraulic feed slide moves in to finish bore the hole on a taper. Feed rate for the grooving operation is .0005″ at 480 R.P.M. The boring operation is to .005″ at 480 R.P.M.

The Job:

Counterbore and hold concentricity on a high production part. Counterbore must be concentric with I.D. within .0008". (Material — aluminum alloy.)

The Solution:

Counterbore two pieces at once on double spindle machine. The table advances both tools to desired depth. The cross-slide then feeds toward the operator to face the bottom of both pieces. The work is held on the I.D.* with air operated collet arbors.

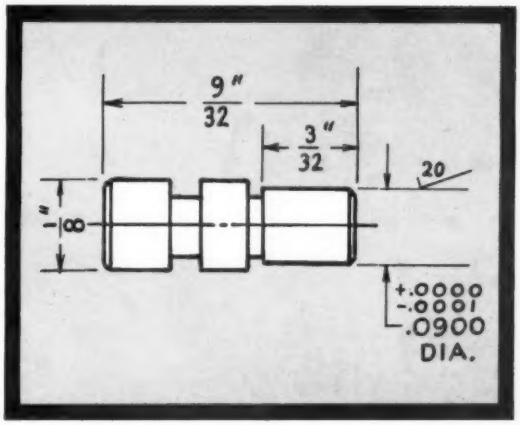


The Job:

Turn and chamfer parts too small for intended centerless grinding. (Material — Stainless SAE 30310.)

The Solution:

Hold in air-operated diaphragm chuck on ⅛" dia. Turn .090" dia. and cut chamfer at end of stroke. A single carbide tool was used on this high production job. The operator had only to load, push the automatic cycle button and unload.

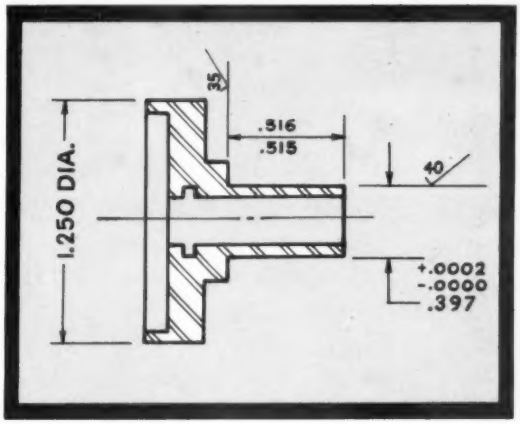


The Job:

Turn .397" dia., face end, and cut "O" ring groove. (Material — 303 stainless steel.)

The Solution:

Hold on 1.250" dia. in air operated chuck for turning and facing. Part is then reversed and held on .397" dia. for cutting "O" ring groove in second operation. Closed cycle feature assures fastest possible cycle as machine is in rapid motion except when cutting groove.



■ *Send financing and leasing information . . . plus . . . catalogs containing complete details on:*

- ☐ 6" x 15", 6" x 36", 12" x 45" Automatic Thread Grinders
- ☐ Model F Automatic Thread Grinders
- ☐ Model E-2 and E-3 Automatic Form Grinders
- ☐ Model 410 Thread Grinder
- ☐ Precision Boring Machine
- ☐ Precision Gun Drilling Machine

Name.....

Title.....

Company.....

Street.....

City.....Zone.....State.....

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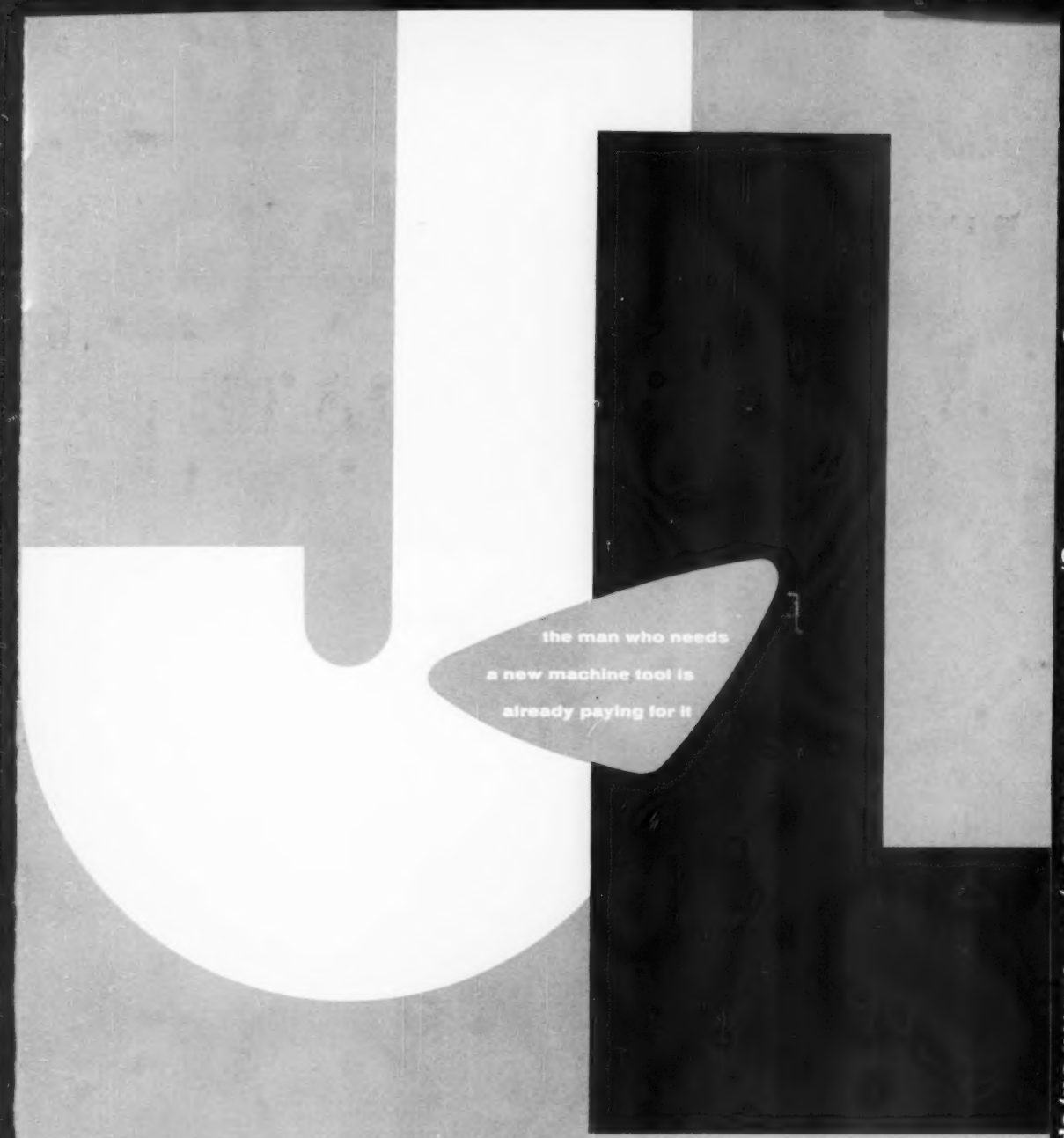


PRECISION

GRINDING · BORING & GUN DRILLING

JONES & LAMSON MACHINE COMPANY

If the J & L Grinding insert is missing, write JONES & LAMSON, 502 Clinton St., Springfield, Vermont, for your copy.

Switch Control:

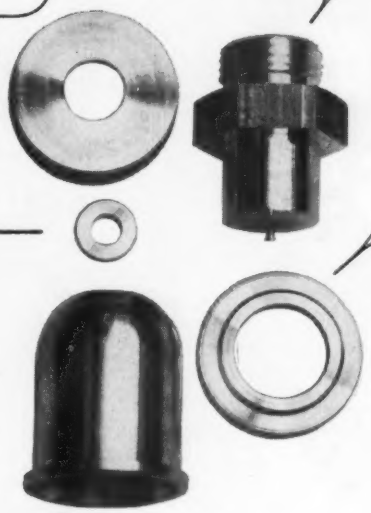
Another Olin alloy change saved the manufacturer about 7% on metal and resulted in higher machine operating speed.

Aircraft Fitting:

Superior surface finish of Olin hexagonal bar eliminated need for secondary finishing operation.

Clock Time Wheel Hub:

An Olin-recommended alloy change resulted in a raw material cost saving of 11%.



Fuel Valve Body:

Olin rod and Olin technical help reduced machining time from 5.5 to 2.4 seconds.

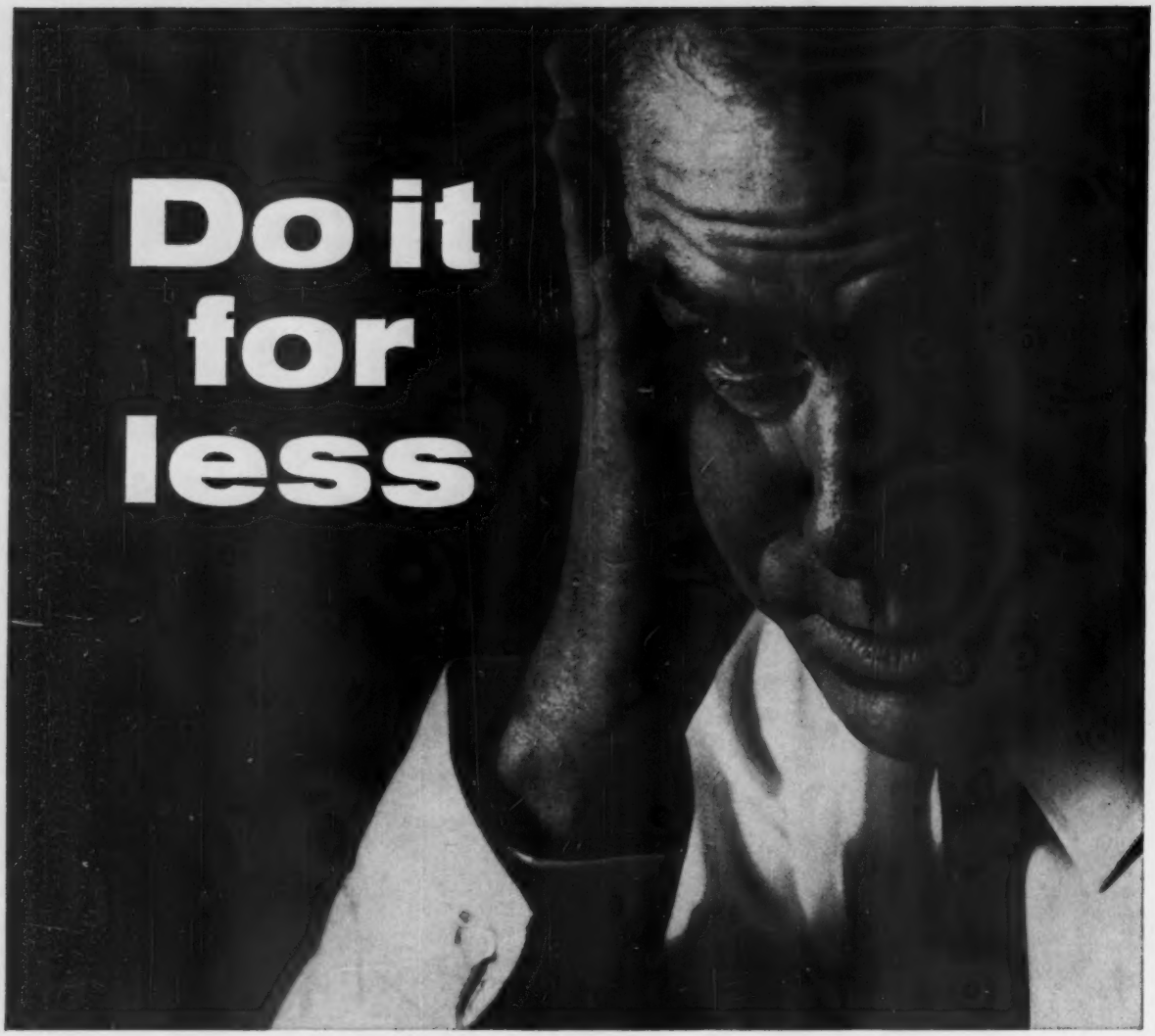
Electronic Part:

The high quality of Olin Aluminum improved the surface finish 25%. Reduced machine down time.

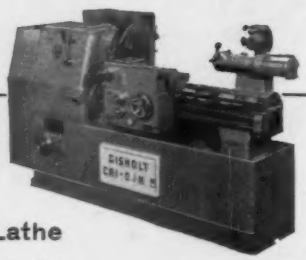
We speak your language: savings!

These endorsements from various manufacturers are typical of the results achieved through Olin's technical assistance—and the use of Olin Aluminum Rod and Bar. Olin *cold processed* Aluminum Rod and Bar is ideal for screw machine products because of its uniform structure and fine surface finish. Olin's Distributor network, coast to coast, carries a full range of this stock in a variety of sizes and alloys. These same Distributors, or your nearest Olin Aluminum Sales Office, will arrange for Olin's technical and marketing service if you'd like some help. Look in The Yellow Pages.

Olin
ALUMINUM
400 PARK AVE., NEW YORK 22, NEW YORK



ON A CRI-DAN AUTOMATIC THREADING LATHE



Gisholt CRI-DAN Model B Automatic Threading Lathe

Sets up in 8-15 minutes.

Inexpensive single-point carbide tools produce all types of internal and external threads: Single- or multiple-start, Coarse or fine, Left- or right-hand, Straight or tapered, Standard or special form—in any material, including new high-tensile, hard alloys.

Call your Gisholt Representative or write for Catalog 1215.

Can you afford to stay with conventional threading methods and pass up savings of 30% to 80%?

These savings can be yours with a Gisholt CRI-DAN High Speed Threading Lathe. Times are drastically reduced. You use single-point carbide tools. Quality threads—simple or complex—are produced automatically.

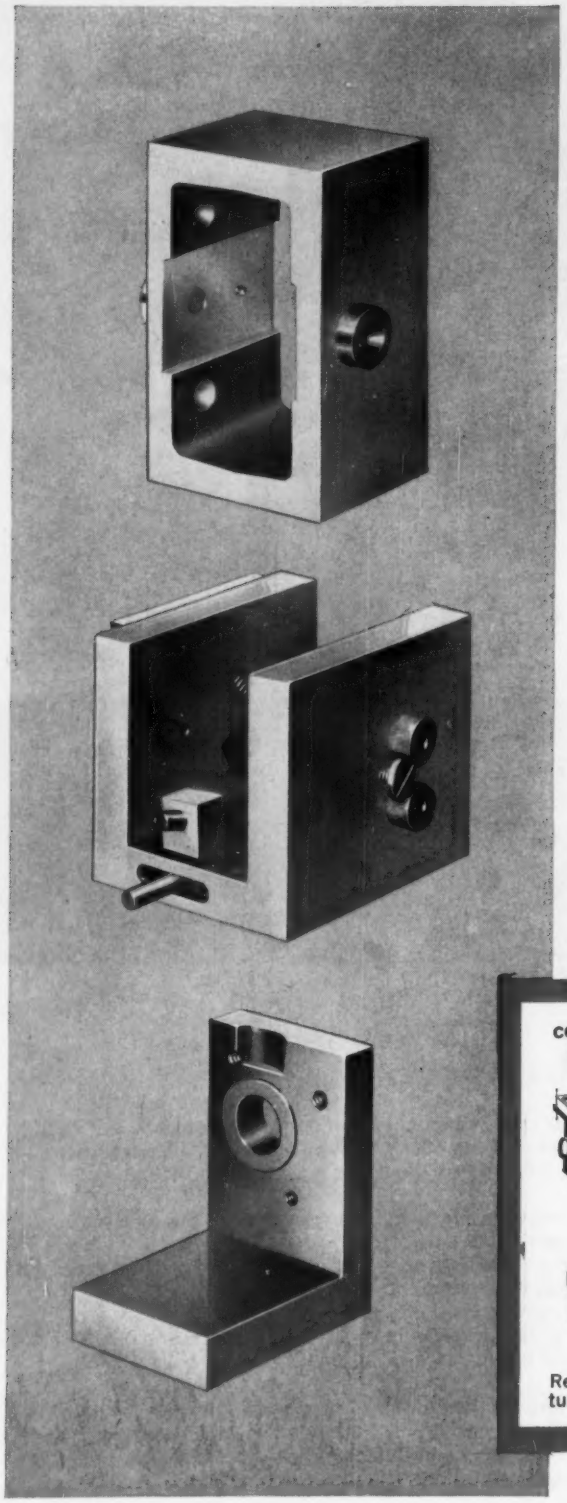
Whether you're threading in lots of 6 or 600, the CRI-DAN method will do it for less.

GISHOLT

MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee



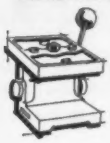
Build Fixtures Faster, at Lower Cost with Ex-Cell-O Micron Sections!

Available for immediate shipment, Ex-Cell-O Micron Sections are pre-machined square and parallel from high tensile strength cast iron to save you design and fabrication time.

Ideal for job-lot tooling, Micron Sections are cut to order from standard 25″ lengths. Wall thicknesses range from ⅝″ to 1¼″, with overall dimensions from 3″ x 3″ to 8″ x 10″.

Call your local Ex-Cell-O Representative or Distributor, or contact Ex-Cell-O direct. Phone TOwnsend 8-3900; TWX—DE 876; Wire ZTC.

COMPONENTS FOR ALL YOUR JIG & FIXTURE NEEDS—AVAILABLE IMMEDIATELY FROM A SINGLE, RELIABLE SOURCE!



Lift Swing Fixtures for fast drilling of difficult holes.

Fixture Components Clamp Assemblies & Fixture Details.

Drill Jig Bushings Chrome alloy bearing steel • Tungsten carbide • Trans-Lok, Press-Lok for plastic jigs.

Reader Service Card Number is for Micron Sections Literature only. Request literature on above items separately.

61-19 BU

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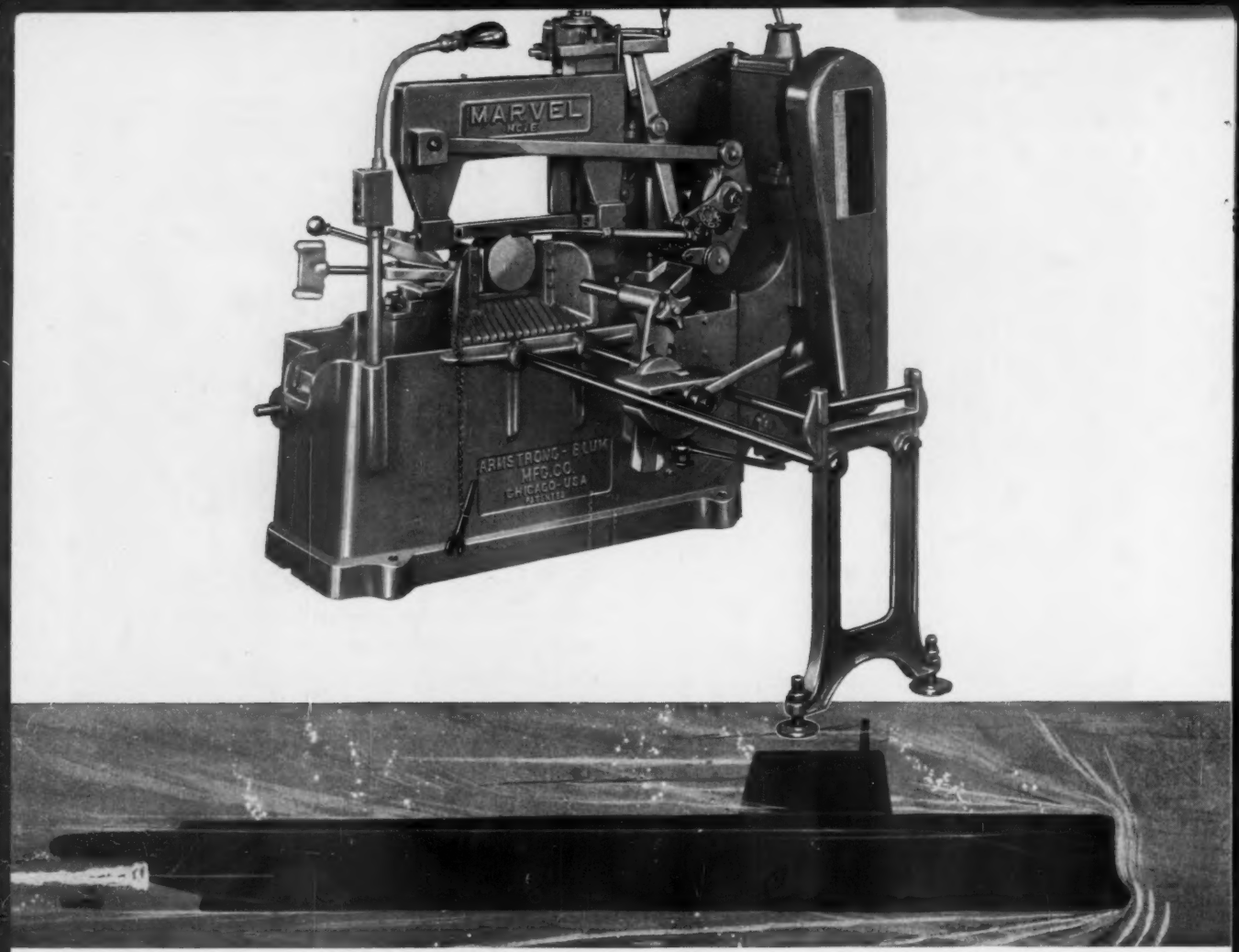
Bushing Sales Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



OBSOLETE ?

Emphatically no—not when a Marvel Hack Saw like this one can cut 4600 blanks of 3¼" round 303 stainless steel for just 1½ cents blade cost per cut—not when these 4600 blanks were cut-off at the rate of 20 pieces per hour, floor to floor! And this is typical production performance at that.

Obsolete? This Marvel Hack Saw Machine is as modern in performance as the next atomic powered submarine that will slide down the ways!

If you want faster cutting, the Marvel Hack Saw has speed to spare; accuracy of cut is assured by the rugged construction of the machine itself; blade cost, in many cases is less than 1¢ per cut.

When you consider these advantages and their low initial cost, Marvel No. 6 and No. 9 Series High Speed Heavy Duty Ball Bearing Hack Saws, as we build them, are your best cutting-off equipment buy today.

We can prove our point by demonstrating Marvel Sawing efficiency on your own work, without any obligation on your part. Because we have consistently built both Hack Saws and Band Saws for more than 40 years, we will give you an unbiased recommendation.

Catalog C-60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL *Metal Cutting* **SAWS**

BETTER MACHINES
BETTER BLADES

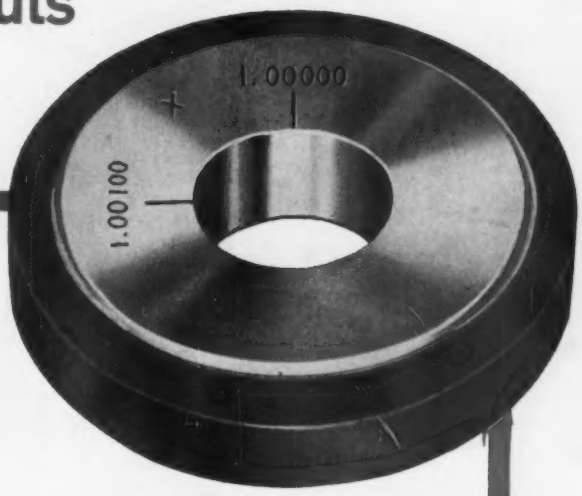
ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

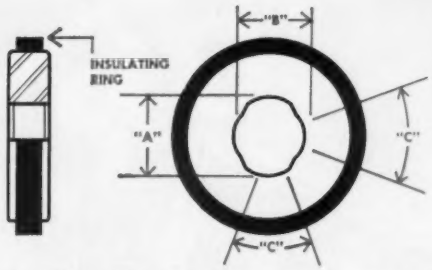
S-1317

CIRCLE 325 READER SERVICE CARD

Using air gages?

this Bryant 2-D master setting ring speeds inspection, cuts gage needs in half!





1. Slide 2-D Gage over pneumatic plug. Adjust air gage indicator to high or low limit on scale, corresponding to "A" (max. dia.) or "B" (min. dia.).

2. Rotate 2-D Gage to its second diameter. Repeat gage calibration.

Surface finish within 40° working areas "C" is 4 micro-inch (RMS) or better.

Here's what you can do with the 2-D Master Setting Ring Gage . . .

- Reduce cost and inventory of master setting rings
- Calibrate spindle-type air gages faster than ever
- Control high and low indicator drift with one master ring
- Check wear of different-size pneumatic plugs with one gage

Bryant 2-D Master Setting Ring Gages are made to your required product tolerances, within Class X gage accuracy. Because there's no need for a pair of masters, your costs and inventory go down. Because there's no wasted gaging motion, your inspection efficiency goes up!

Available in standard sizes from .365" to 2.510" I.D.; special sizes made to order. Call or write direct for price and size data.

61-63B

EX-CELL-O FOR PRECISION

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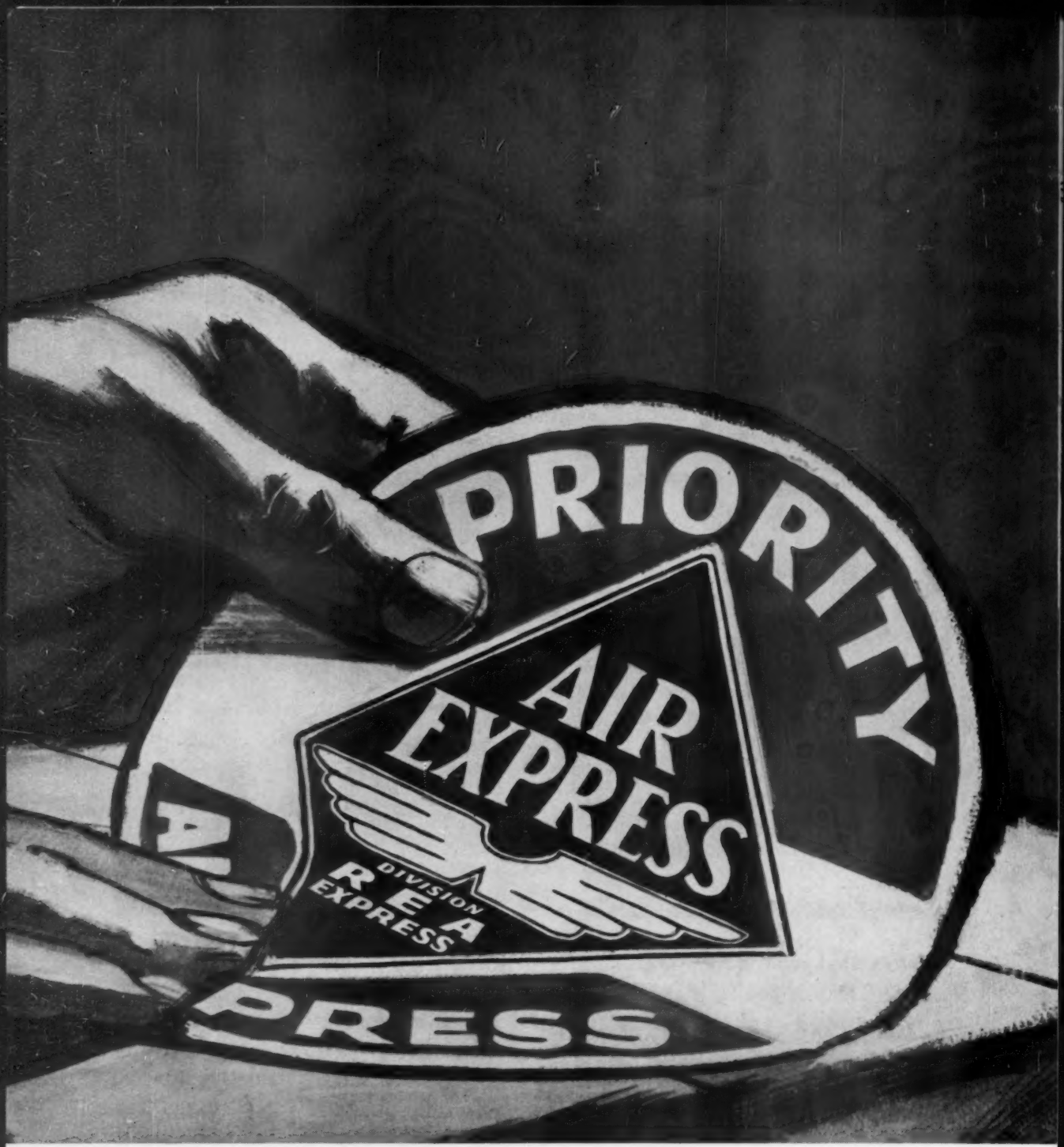
EX-CELL-O CORPORATION

Greenville Plant · 945 E. Sater St., Greenville, Ohio



Only this label can assure you of AIR EXPRESS priority service

Let's clear up a frequent misunderstanding: AIR EXPRESS is not a general term for all air freight. It's a specific air-ground shipping service: AIR EXPRESS Division of R E A Express. Many businessmen learn this the hard way. They assume that the famous AIR EXPRESS advantages of jet speed and door-to-door service apply to all air shipping companies. It just isn't so. There's only one way to be sure your shipment is first on, first off, first there—via all 35 scheduled U. S. airlines. Or gets kid-glove handling throughout the U. S. and Canada. And that's to be sure it gets this label. If it doesn't . . . it's not AIR EXPRESS.

AIR EXPRESS

CALL YOUR LOCAL R E A EXPRESS OFFICE FOR AIR EXPRESS SERVICE

NOW—An Automatic Form and Groove Grinder . . . designed for tomorrow's production requirements!

WORKPIECES—Standard Ex-Cell-O Model 973 takes parts up to 24" long. Can be equipped for parts with 36" centers. Workhead adjustable for angular settings.

OPERATIONS—Precision-built for rough, semifinished or finished production grinding.

CONTOURS—Grinds straight, angular and radius grooves, and a variety of forms. Grinds multiple grooves when fitted with two or more wheels.

CYCLING—Fully automatic cycling, including opening and closing hood. Rapid wheel slide advance and return for maximum productivity.

SIZE CONTROL—Automatic wheel dressing after each cycle or any number of cycles. Automatic wheel size compensation after each dressing. (Handwheel graduated to .0002" for manual setting.)

DRESSERS—Designed for use with all standard Ex-Cell-O Diamond Dressers, or any special rotary diamond-set wheel dressers.

ACCESSORIES—Model 973 is a complete, versatile machine with extensive automatic features. However, it is designed to be easily equipped with automatic work loading and unloading devices, air operated chuck and tailstock and other accessories to meet your special requirements.

DATA AVAILABLE—Contact your local Ex-Cell-O Representative, or write direct for descriptive literature and engineering data.

61—25M

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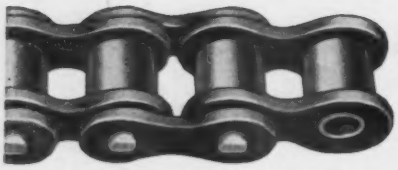
Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

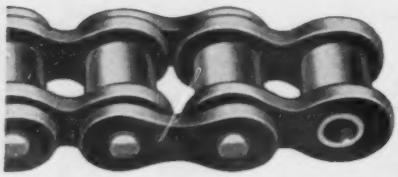
◄ CIRCLE 327 READER SERVICE CARD

CIRCLE 328 READER SERVICE CARD

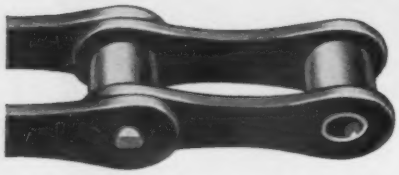


SINGLE STRAND

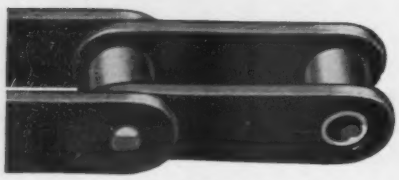
DOUBLE STRAND



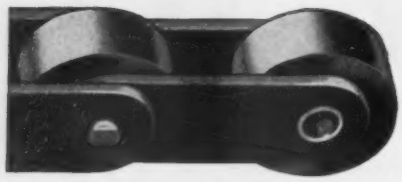
SINGLE STRAND, HEAVY SERIES



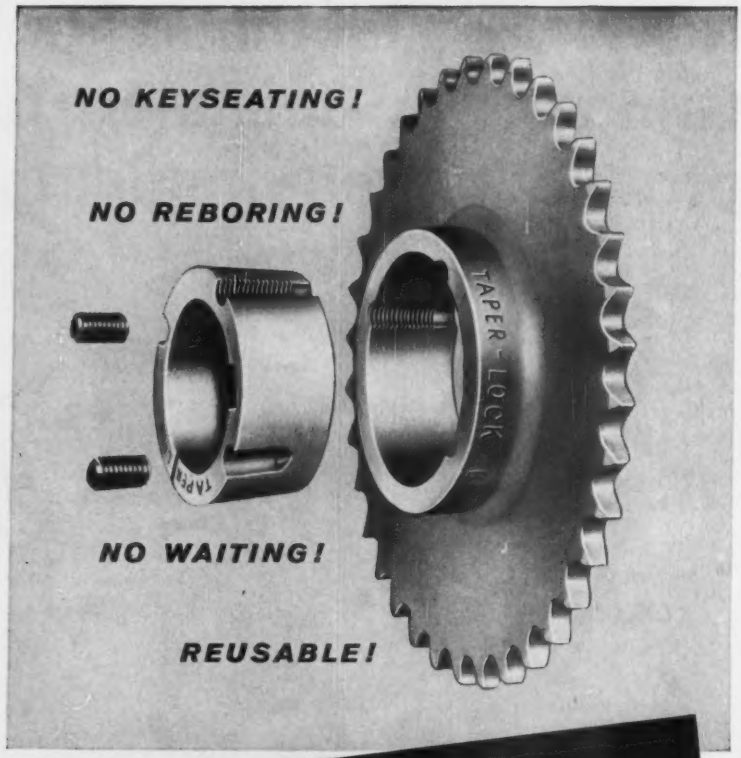
DOUBLE PITCH TRANSMISSION



DOUBLE PITCH CONVEYOR



DOUBLE PITCH CONVEYOR, LARGE ROLLERS



TAPER-LOCK SPROCKETS DODGE ROLLER CHAIN

DODGE Quality Roller Chain, teamed with Dodge Taper-Lock Sprockets, results in chain drives and chain conveyors that have the precision, efficiency and stamina necessary for the real economy of *long life*.

Moreover, Taper-Lock's reusable bushing makes a difference in overall cost. The ease of Taper-Lock mounting, the elimination of reboring, keyseating, and wasted time, add to the saving. Precision machining and true articulation lengthen the life of *both* sprocket and chain.

The Dodge line of chain, including standard attachments, is extensive. It meets a high percentage of all chain requirements.

In the Double Pitch series (both Transmission and Conveyor) the sizes which require special spacing for perfect tooth action are offered from stock in special double pitch design — to double the life of the chain and the sprocket!

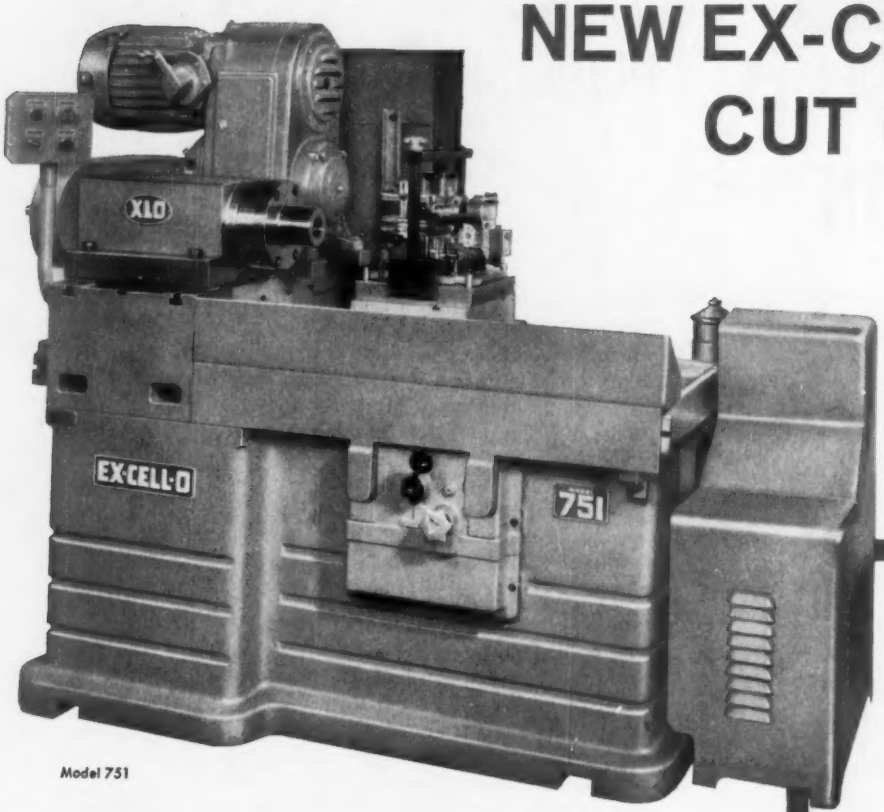
Ask your local Dodge Distributor. Or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 100 Union St., Mishawaka, Ind.

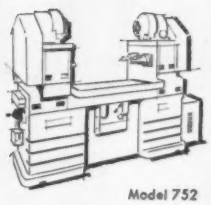
DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

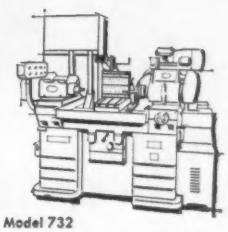
7 REASONS WHY THESE 4 NEW EX-CELL-OS CUT COSTS



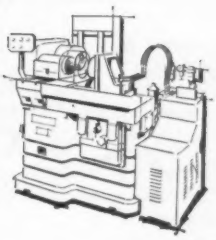
Model 751



Model 752



Model 732



Model 731

Designed and built for maximum dimensional stability under all operating conditions, these new hydraulically operated precision boring machines offer the ultimate in accurate repeatability.

Check these features for production efficiency . . .

- **Temperature controlled hydraulic panels**
- Extreme rigidity and stability in bases and tables
- Hydraulic and coolant system externally mounted
- Ex-Cell-O standard and tapered roller bearing spindles
- Designed for close-tolerance precision boring, turning, facing, counterboring, chamfering, grooving, recessing and trepanning operations.
- May be operated either manually or automatically.
- Engineered for simple installation into automated production lines.

Contact your Ex-Cell-O Representative or write direct for details.

61-87M

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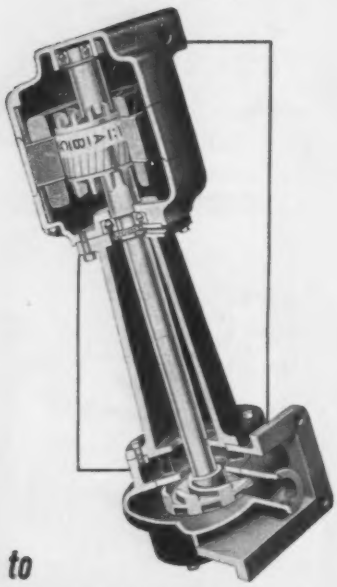
Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Gusher

Coolant Pumps are PRECISION BUILT



to

- LAST LONGER
- PERFORM BETTER

ON YOUR MACHINES

You get better performance from your GUSHER Coolant Pumps because they are precision built. The one piece shaft in GUSHER Pumps is electronically balanced to cut vibration to a minimum. Ball bearings are pre-lubricated, no seal or packing needed. Write for catalog.

THE Ruthman MACHINERY CO.

- COOLANT PUMPS
- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

1819 Reading Road • Cincinnati 2, Ohio

LETTER from the PUBLISHER

Prices Up

In his editorial "Just For The Hell Of It" (AM/MM, October 16, 1961), Burnham Finney states: "No convincing reason has yet been advanced for application of a high minimum wage to the machine tool industry." In studying the application of the Walsh-Healey Act to the machine tool industry, the Bureau of Labor Statistics came up with a finding of $1.73 an hour as the prevailing wage. The National Machine Tool Builders' Association urged a finding between $1.39 and $1.49 and questioned the BLS figures. Labor spokesmen want a rate of $2.15.

Basic Economics . . .

The spread between the NMTBA's low figure and the rate labor wants is $.76. If the Secretary of Labor finds in favor of labor officials, this could mean an increase in the minimum wage of almost 55%. Considering the depressed condition of the machine tool industry, the price disadvantage builders face in selling in foreign markets and the urgent need for American industry to modernize, this threat of a substantial increase in labor costs ignores reality.

Elementary economics should tell the Secretary of Labor this is the fastest way in the world not only to raise the price of machine tools but the prices of all the products made on machine tools. At a time when the President himself is trying to hold prices down and American manufacturers are finding it tougher and tougher to compete in world markets, this hardly makes sense.

A Paradox . . .

Men seem to understand and accept natural law. They know when they break it they will suffer. Put your hand under the descending ram of a punch press and anyone knows you'll lose it. Yet these same men seem to think they can flout the laws of economics. The only way to hold prices down is to reduce costs not raise them. The blind application of Walsh-Healey will force them up; right off the chart.

George Reppert

Ex-Cell-O Drill Jig Bushings

Uniform Hardness, Uniform Quality in More Than 11,000 Cataloged Bushings for metal or plastic jigs!

In stock now from coast to coast, Ex-Cell-O Drill Jig Bushings are made from the finest chrome-alloy bearing steel, precision-ground inside, outside and under the head. Steel bushings are held to consistent 62-64 Rockwell C Hole hardness.

Ex-Cell-O carbide bushings are made from the finest material available.

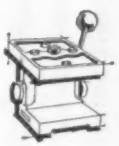
Select from one of the largest inventories in the U. S.

FREE DATA—See your local Ex-Cell-O Representative or Distributor for catalogs and bulletins on Drill Jig Bushings and other jig and fixture cost-cutters. Or contact Ex-Cell-O direct: Phone TOwnsend 8-3900; TWX—DE 876; Wire ZTC.

COMPONENTS FOR ALL YOUR JIG AND FIXTURE NEEDS—AVAILABLE IMMEDIATELY FROM A SINGLE, RELIABLE SOURCE!

Fixture Components—Clamp assemblies and fixture details.

Lift-Swing Fixtures—For fast drilling of difficult holes.



Micron Sections—Cast-iron shapes precut to your needs.

Reader Service Card Number is for Drill Jig Bushing Literature only. Request literature on above items separately.

61-18 BU

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EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

KEYWAY BROACH KITS • SQUARE BROACHES • ROUND BROACHES • PRODUCTION TYPE BROACHES • SPECIAL BROACHES • HEXAGONAL BROACHES • duMONT TOOL BITS • MINUTE MAN® MAGNETIC BASES • MINUTE MAN®

This

Minute Man®

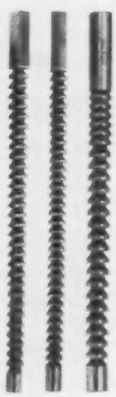
KEYWAY BROACH KIT

paid for itself in

less than a month

And it keeps paying handsome dividends. It cuts keyways *in one minute* for *as little as one cent per keyway*. Any standard size from 1/16" to 1" in any bore from 1/4" to 3".

The No. 30 set pictured is one of many stock Minute Man® sets designed to cut keyway cutting costs. Individual broaches for square, round and hexagonal holes are also available. Mail the coupon for more information.



(A) (B) (C)

Minute Man®

(A) SQUARE BROACHES
For finishing 1/8" to 1" square holes in one pass in cast or drilled bore. (32nd sizes, too)

(B) HEXAGON BROACHES
For finishing 1/8" to 1/4" hexagon holes in one pass in cast or drilled bore.

(C) ROUND BROACHES
For finishing 1/8" to 1" round holes in one pass in drilled bore.

The duMont Corp., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

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duMont

LETTERS

to the editors

330 W 42nd St, New York 36, NY

The Boom in Europe

Dear Sirs:
Your comments on the recent European Machine Tool Exposition (*AM/MM*— Sep 18 '61, p113) and the boom in Western Europe (*AM/MM*—Oct 16 '61, p104) were much appreciated. I also spent five days at the Brussels Show, and my impressions were similar to those which were expressed in your reports.

At the Show, U S representatives were talking about several aspects of the European boom. Since I have returned, I have had further discussions. There is general agreement on the following points:

(1) The European manufacturer is moving ahead so fast because with West Europe's favorable tax laws, he can put more of his profits into new, more productive machinery.

(2) This will have drastic effects on our economy if we do not improve U S tax laws, allowing us to accumulate profits that will go into replacement of existing equipment with machine tools that are substantially more productive.

(3) Capital equipment write-off apparently is much more favorable in Europe than in this country.

(4) We must beat the drum louder than ever for a change in U S tax laws. We must improve our depreciation allowances, or we are going to be hurt real bad by the expansion of manufacturing facilities that is now going on in Europe.

L A Holder
Chief Engineer—Mechanical
Timken Roller Bearing Co
Canton, Ohio

Cost-Cutting Ideas

Dear Sirs:
We have been following with great interest your four-part series, "Fifty-Five Cost-Cutting Ideas." Part III (*AM/MM*—Oct 2 '61, p89-91) was especially interesting, as it discussed various ways to reduce costs on milling operations, which form a large part of our work.

When will Part IV appear, and

SHOPMATES

N. Jarvis

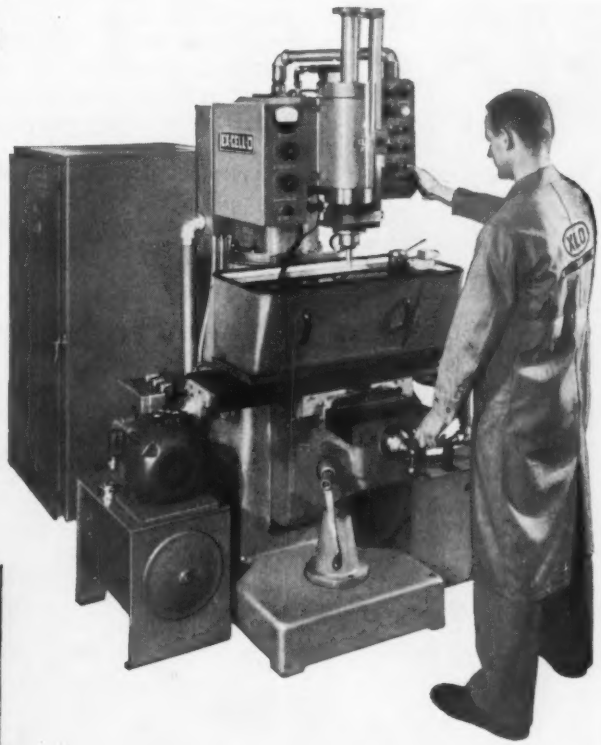
YOU BEEN HOLDIN' OUT ON ME... I DIDN'T KNOW YOU HAD A SINE BAR... I CAN USE THAT... AND THIS PLANER GAUGE... MIND IF I TAKE YOUR INSIDE MICS?? YOU NEVER USE 'EM... ETC/ETC!
GOT A MATCH?
A MATCH??!! THINK THEY GROW ON TREES? I AIN'T NO LOAN ASSOCIATION... ALWAYS BUMMIN'! YOU GOT NO PRIDE! GO GET A LIGHT OFF THE TORCH... TRY A SOLDERIN' IRON... YOU AIN'T ALLOWED TO SMOKE IN HERE ANY HOW!!
N. JARVIS

LECTRA-FORM
Increases Production 500%

Ex-Cell-O Model 244 machines recess 5 times faster, with far lower tool cost!

Ex-Cell-O LECTRA-FORM Machines remove metal through high-current, low-voltage electrical spark discharge. Producing an inverse image of low-cost shaped rod, tubing or sheetmetal tooling, LECTRA-FORM accurately drills, pierces, trepans, slots, cuts or sinks intricate cavities in carbides and other conductive materials difficult or costly to machine by other methods.

Contact your Ex-Cell-O Representative for details, or write for LECTRA-FORM Bulletin 436014.



Model 244 has an electro-hydraulic servo for automatic tool feed and gap control, removes metal without distortion due to tool pressure. Inset photo shows part before and after 8-minute LECTRA-FORM machining.

HERE'S HOW LECTRA-FORM COMPARES TO CONVENTIONAL MACHINING

WORKPIECE Nickel-alloy aircraft part*	LECTRA-FORM MACHINING	FORMER METHOD
Tooling	Low-cost brass rod	Small end-mill cutter
Tool cost	Negligible	High wear and breakage
Accuracy	Uniform wall thickness	Distorted wall contour
Machining time	**8 minutes**	**40 minutes**

*Depth of recess approx. .080", wall thickness approx. 1/32".

61-30M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPOSITE PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

1. INSTALL MACHINERY FAST
2. LEVEL 3. LICK VIBRATION

NEW LEVEL-RITE SERIES 500

Cut machinery installation time and costs up to 70, 75, even 80% . . . eliminate transmitted vibration up to 85%! That's the money-saving move with Level-Rite Series "500" — latest member of the Unisorb family. No lagging, no cement, no drilling, no "hit or miss" spotting is needed. Unisorb Level-Rite mounting is fast — machines can be moved and relocated quickly and with a minimum of downtime.

Level-Rite Series "500" is a self-contained leveling mount for light and medium duty machine shop tools. It withstands weights up to 750 lbs. Send for literature.

SPECIAL ADVANTAGES: Fast, simplified, precise leveling • Free-floating screw post — compensates for uneven floor • Safe, sure grip — can be cemented if needed • Lowers noise level — increases worker efficiency • Better machine performance (improved alignment) • Available in many types and thicknesses for all machine types • Money-back trial is yours for the asking.

FEO-42

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Division of The FELTERS Company
New York, N. Y. • Chicago, Ill. • Detroit, Mich. • Upper Darby, Penna. • St. Louis, Mo. • Taylor Felt & Supply Co., San Francisco, Calif. • Acorn Mfg. Co., Los Angeles, Calif.

Please send me a Unisorb Sample and Free Book ☐
Please send literature on Unisorb Level-Rite "500" ☐

Name.....
Company.....
Address.....
City.....Zone.....State.....

will it be possible to obtain reprints of the individual articles?

C B Chapman
Chicago, Ill

The fourth and final article in this series appears in this issue (see p118-119). All four articles are being reprinted under one cover. For information on ordering this 11-page reprint, see p 119—Ed.

Next Inventory

Dear Sirs:
We have used your *Eighth Inventory of Metalworking Equipment* extensively in our modernization studies. But this survey was made in 1958, and there must have been quite a few changes in the machine-obsolescence picture since then. Have you made any more recent studies along these lines?

T R Knapp
New York, NY

The AM/MM Inventory, a 96-page report on the types of machine tools in U S metalworking plants, and the machine ages, is such an enormous study that it is undertaken only once every five years. The next Inventory will appear in 1963. An interim up-dating of the Eighth Inventory, estimating the trend in machine obsolescence between 1958 and 1961, appeared in a recent issue. See "More Old Machines Than Ever," AM/MM—May 29, '61, p55-57—Ed.

AM/MM
"Walker hit me up for a raise at a bad time—business is great."

CALENDAR

National Electrical Manufacturers Association — Annual Meeting, Nov 16, Plaza Hotel, New York.

Society of Carbide Engineers — Annual Meeting, Nov 18, Belmont Plaza Hotel, New York.

American Society of Mechanical Engineers — Winter Annual Meeting, Nov 26-Dec 1, Statler Hilton Hotel, New York, NY.

Society of Automotive Engineers —Annual Meeting and Display, Jan 8-12, Cobo Hall and Convention Arena, Detroit, Mich.

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Statler Hilton Hotel, Washington, DC.

Society of Plastics Engineers — Annual Technical Conference, Jan 30-Feb 2, Penn-Sheraton Hotel, Pittsburgh, Pa.

Material Handling Institute — Spring Meeting, Feb 6-8, Hilton Inn, Atlanta, Ga.

American Society for Metals — Golden Gate Metals Conference, Feb 15-17, Fairmont Hotel, San Francisco, Calif.

Society of Automotive Engineers — National Automobile and Production Meeting, Mar 12-16, The Sheraton Cadillac, Detroit.

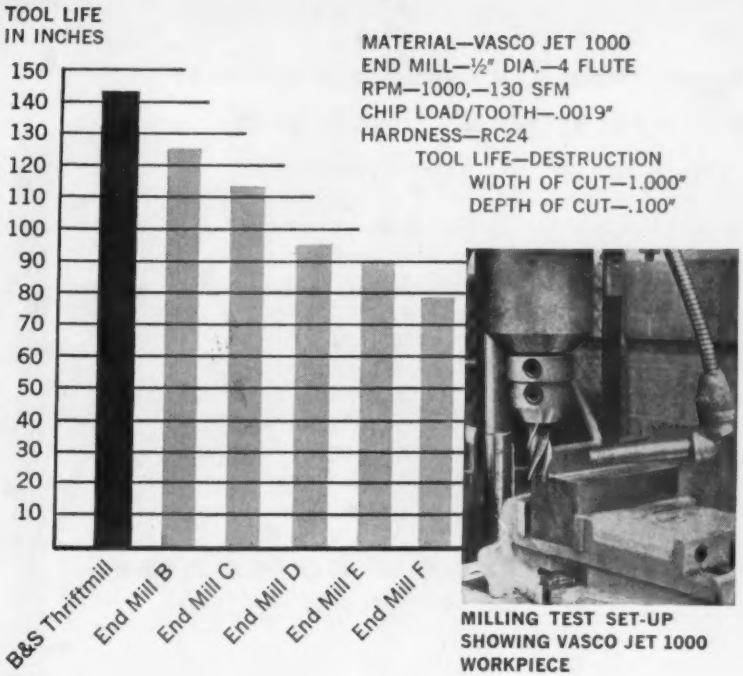
Pressed Metal Institute — Spring Technical Meeting, Mar 14-16, Commodore Perry Hotel, Toledo, Ohio.

Society of Automotive Engineers —National Aeronautic Meeting and Display, Apr 3-6, Hotel Commodore, New York, NY.

American Welding Society—43rd Annual Convention and Exposition, Apr 9-13. Technical Meetings, Sheraton Cleveland Hotel; Welding Show, Cleveland Public Auditorium, Apr 10-12, Cleveland, Ohio.

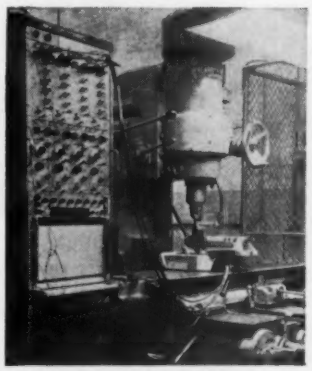
American Foundrymen's Society —Castings Congress and Exposition, May 7-11, Cobo Hall, Detroit, Mich.

American Institute of Industrial Engineers — National Conference, May 17-19, Ambassador Hotel, Atlantic City, NJ.



MILLING TEST SET-UP SHOWING VASCO JET 1000 WORKPIECE

B&S Thriftmill® wins tooling torture test at North American Aviation!



8 CHANNEL RECORDER, DYNAMOMETER AND MILL.

Thriftmill cuts Vasco Jet 1000 Steel . . . 142 inches at 130 Surface feet/minute.

It is interesting to note that the best tool life of 142" at 130 SFM produced complete break down destruction of cutter, but in later tests, on the same hardness of material, 2016" of tool life with only a .010" wear land was acquired at a more normal speed of 43 SFM.

This (Thriftmill) cutter is unique from others in this series of tests for the reasons that it is cheaper to purchase than standard cutters and its geometry is quite different.

Of course, this is what B&S has been saying all along— THRIFTMILLS ARE DIFFERENT!

For that EXTRA Edge in Production!

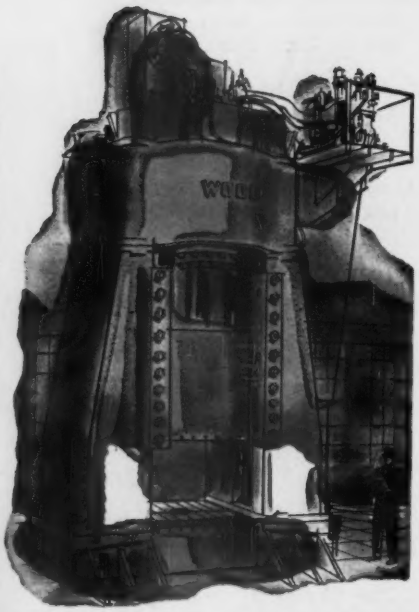
Brown & Sharpe

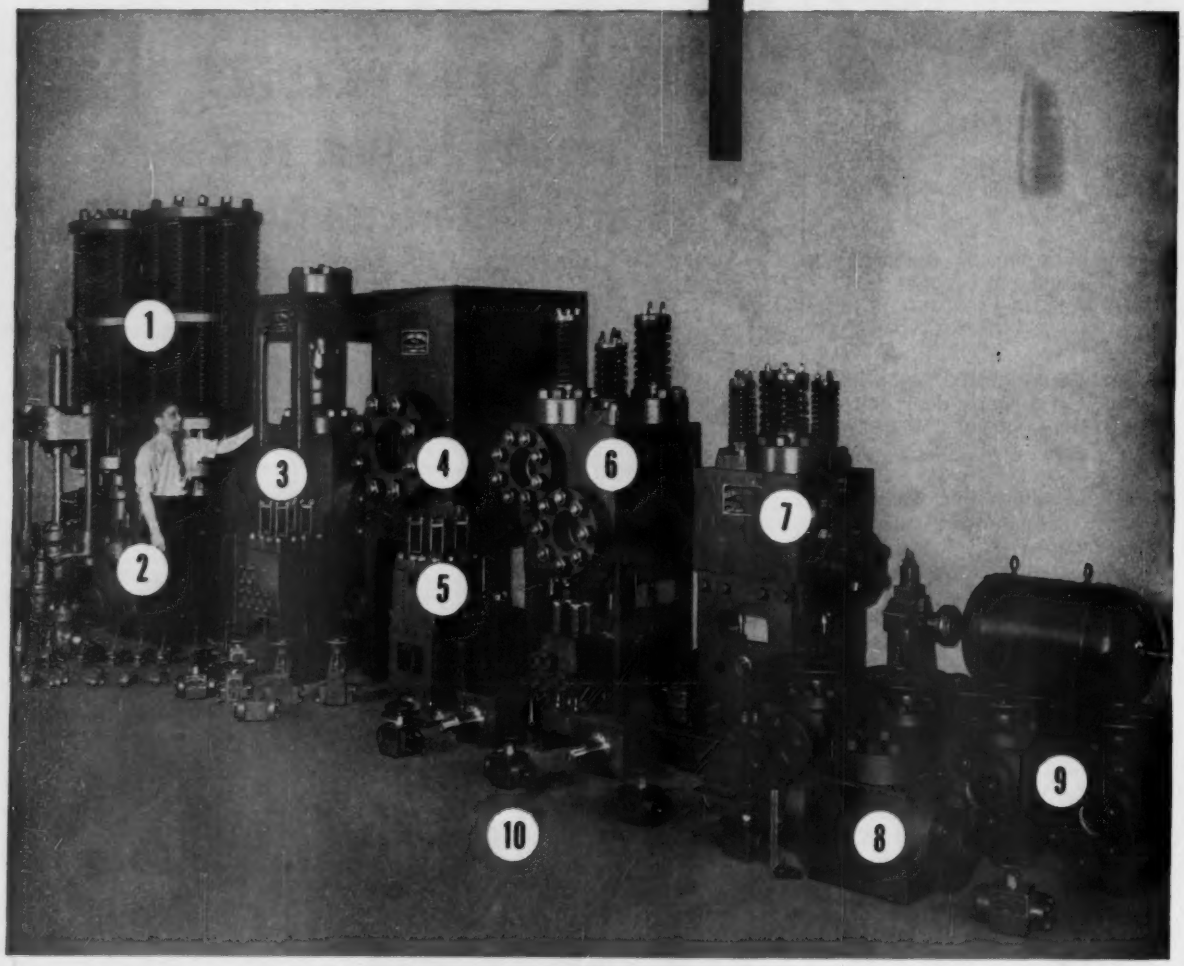
Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

Every valve you need for a complete hydraulic system . . . from WOOD

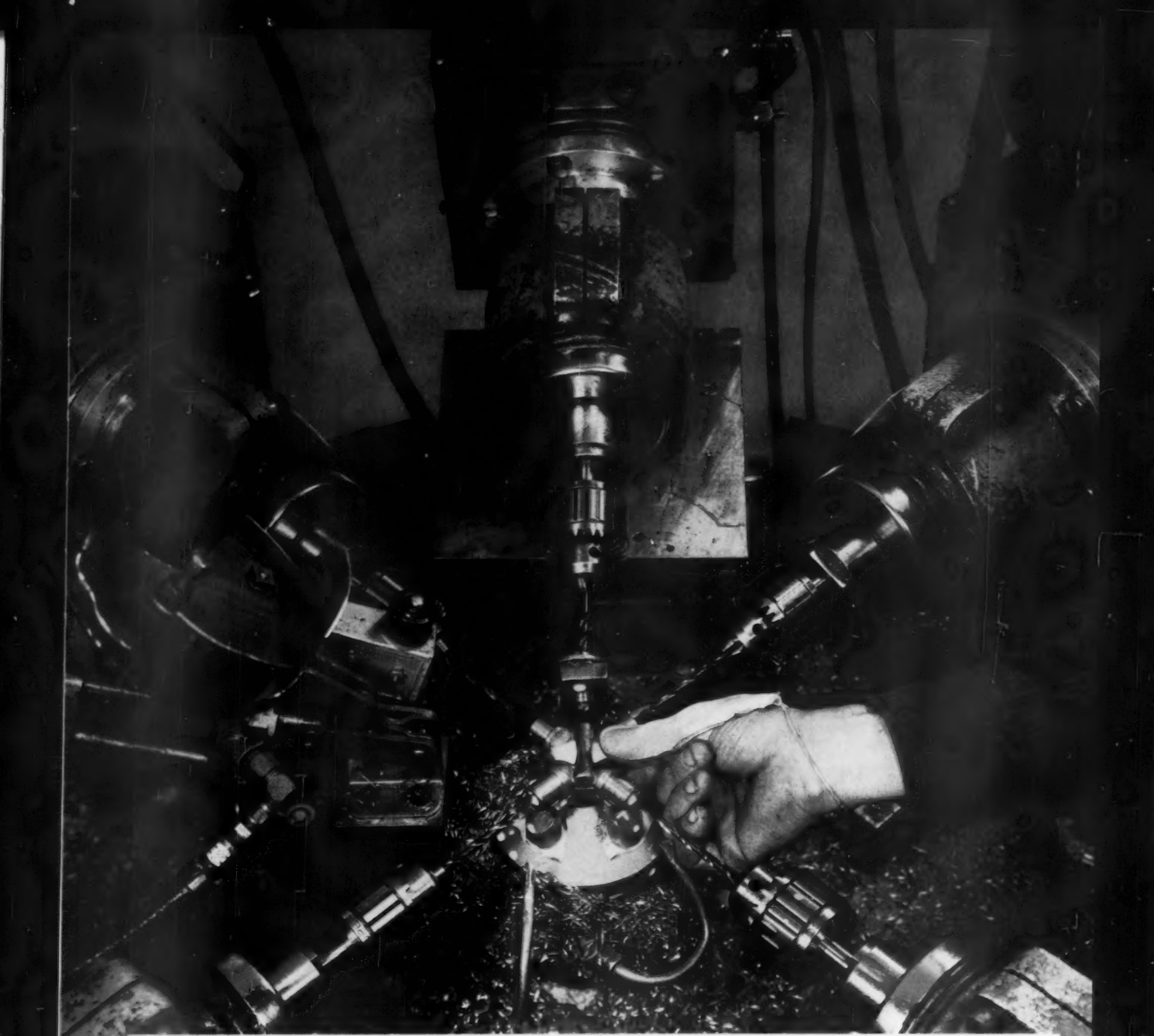
Need a special valve or a complete hydraulic system? Call on R. D. Wood Company for help from men who know their high pressure valves. Take the line-up below, all Wood valves from one hydraulic forging press installation, working pressure 4500 psi. Note the broad range of sizes and types, from the small Stop and Check Valves to the large 6" x 8" Shock Alleviator Valves. They have been developed from years of experience in designing and building hydraulic equipment. Whatever your requirements, our engineering staff can design and apply the correct valves to do the job. Write today for complete information contained in the Wood brochure, "High Pressure Hydraulic Valves."

R. D. WOOD COMPANY
FLORENCE, NEW JERSEY





1. 6"x8" Shock Alleviators **2.** 2½"x4½" Twin Tilting Valve **3.** 9" Accumulator Shut off Valve **4.** 9" Accumulator Safety Shut off Valve **5.** 1½" Mandrel Gear Control Valve **6.** 6" Control Valve **7.** 4½" Control Valve **8.** 4" Check Valve **9.** 4" Stop Valves **10.** Misc. Stop, Check and Control Valves



FAST AS THE EYE CAN FOLLOW

Drilling five 1⅛" deep holes at once in forged steel "spiders" for universal joints, these drills move in and out about as fast as the eye can follow on this high production job at the Saco-Lowell Automotive Division plant in Saco, Maine.

At this speed, even a few minutes down time means considerable loss of production. That's why they insist on quality tools, tools they can depend on to stand up day in and day out, month after month, tools that are uniform order after order.

Specially researched GREENFIELD-AMPCO drills have been on this operation longer than any other make in the long history of this gruelling job.

GREENFIELD TAP & DIE GREENFIELD, MASSACHUSETTS

98% "UP-TIME"

WITH HUGHES NUMERICAL CONTROLS

Hughes Numerical Controls can help keep your up-time extremely high. In fact, customers report down-time of as little as 2% of productive time after thousands of hours in operation. (Ask any company that uses Hughes Numerical Controls.*) The reason: HUGHES RELIABILITY. Hughes' electronic engineering know-how combines transistorized circuitry, modular construction and photo-electric tape readers to achieve true RELIABILITY. This means lower operating costs, greater productivity and higher profits to you. If you can't afford down-time, get the facts. Find out more about RELIABLE Hughes Numerical Controls. Write, wire teletype (INGL 4117) or call direct: Hughes Industrial Control Systems, Dept. No. 92-21, P. O. Box 90904, Los Angeles 9, California.

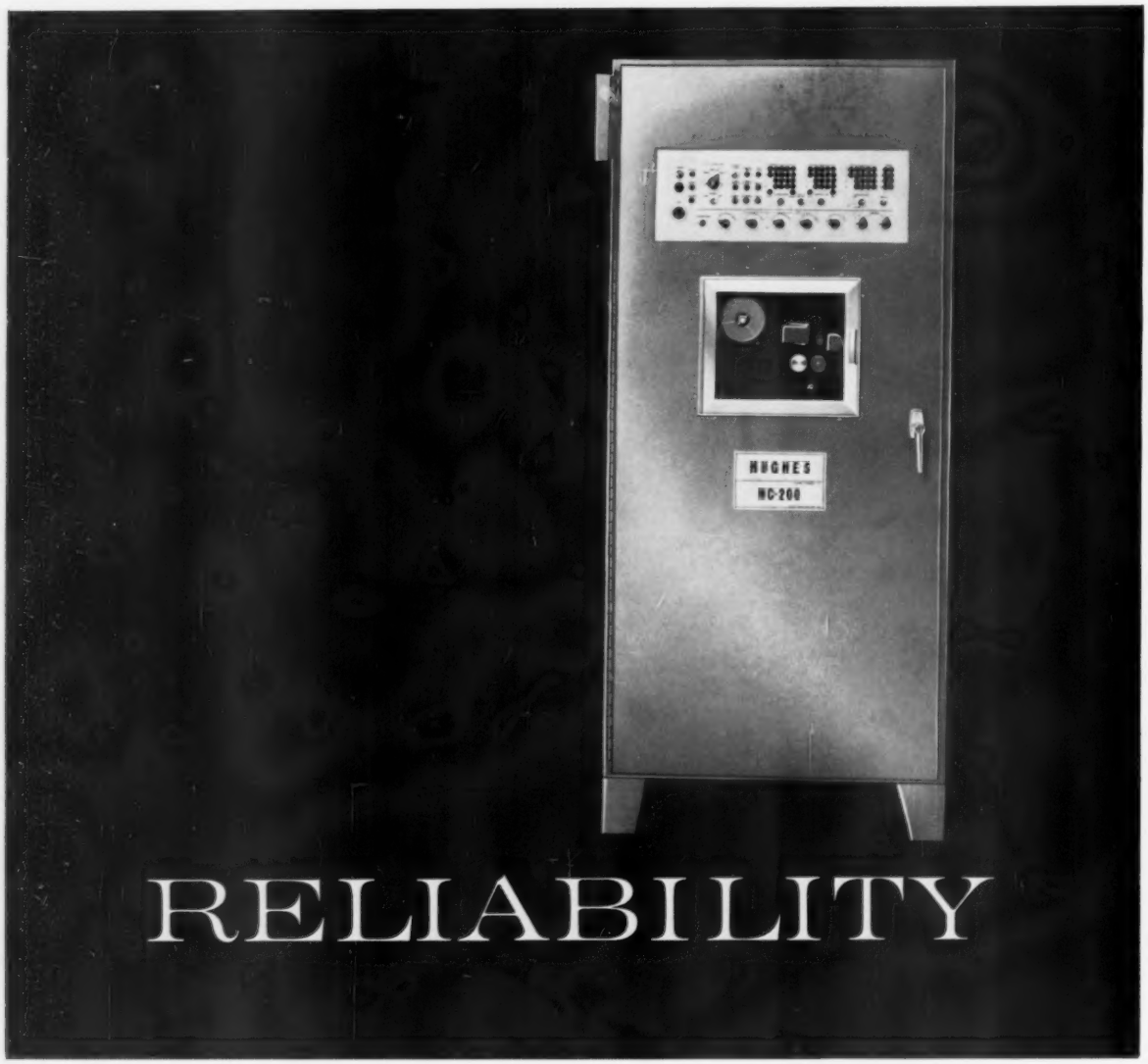
List of companies in your area using Hughes Numerical Controls supplied on request.

CREATING A NEW WORLD WITH ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY

INDUSTRIAL SYSTEMS DIVISION



RELIABILITY

SPOT NEWS...

- **Russians claim their Kharkov turbine plant has built a giant vertical lathe** that can handle parts up to 65 feet in diameter and weighing up to 400 tons. Tass also reports the development of an electronically programmed machine capable of machining parts weighing 3000 pounds to an accuracy of two microns.

- **"Spur" gears with longitudinally curved teeth** are being developed by Gleason Works. Called zerate gears, they have a helix angle at the center of the tooth of zero degrees, increasing toward each end to as much as 30 degrees. They cannot be assembled axially, but have a self-centering action. Gleason is now designing equipment for quantity production if a demand develops.

- **Ford (Detroit) has placed a multimillion dollar order with Ford of Canada** for rear-axle components. Ford of Canada won the order in competition with US manufacturers. A substantial portion of the order is being contracted with several Canadian suppliers, reports K E Scott, president of Ford of Canada.

- **Capital spending by the metalworking industry will hit $3.97 billion in 1962.** Total investment for new plant and equipment by American business as a whole will be $35.84 billion, a figure which would make 1962 the second highest year on record. Preliminary estimates of capital spending for 1963 are close to those for 1961. For full details, see page 117.

- **A federal grand jury has indicted Huck Mfg Co and Townsend Co** of conspiring to fix prices and monopolize the industry through patent agreements on Lockbolts. The Justice Department charged that the defendants—the presidents of both firms were also named as defendants—met secretly and decided that Townsend would follow Huck prices so long as Huck, the patent holder, did not license any other companies to make and sell Lockbolts.

- **Boeing Applied Computing Services (Wichita, Kansas) has been disbanded.** Boeing is redirecting certain corporate programs so as to satisfy the increasing demands of its prime programs. The numerical control course currently being offered under joint NMTBA-AMTDA sponsorship will be carried through to completion.

- **New Britain Machine Co will manufacture the Morey vertical profiling** and milling machines at its Lucas Machine Division plant in Cleveland. New Britain will build the complete line of Morey profilers, including 3-, 4-, and 5-axis models, with automatic control provided for all movements either through tracer or numerical control.

- **The new Diamond Application Development Laboratory** set up by GE's Metallurgical Products Dept (Detroit) will investigate new and improved diamond applications, evaluate new types of GE man-made diamonds, and analyze comparative performance testing operations.

- **Commercial packaged electro-hydraulic forming system,** just put out by Westinghouse and claimed to be the first of its kind to go on the market, consists of an energy module, coaxial cables, and a control console. System can store up to 42,500 joules (20,000 volts) and can be charged to full voltage in about three minutes. Rate of discharge is 33 microseconds per cycle.

- **Program to have one company retrofit numerical controls** to 43 Cincinnati contour milling machines (*AM/MM*—Jun 26 '61, p57) has been cancelled by the Air Materiel Command. Air Force has decided to let individual prime contractors make their own decisions and proposals in those cases where retrofitting seems deirable on their machines. More than half the machines were originally built to be compatible with numerical control.

1. Efficient. An important addition to Simonds line of quality cutting tools, Simonds new Hole Saws saw holes cleanly and efficiently in machinable materials up to 1⅛" thick. Ideal for portable tools, drill presses, lathes, boring mills, and milling machines . . . Simonds floating pin-drive arbor assures positive non-slip cutting.

2. Shatterproof. Made with a special wear-resistant high speed steel cutting edge, these saws *stay sharp* for exceptionally long periods. Rugged. Tough. Simonds cutting edge is permanently bonded to a tough alloy steel body for maximum strength and resiliency . . . makes these the sturdiest hole saws you can buy.

3. Easy-Out. Simonds knock-out slots allow easy removal of cores. "Follow through" design of cap permits sawing deep holes in stacked or layers of material where cores can be removed. Now available from your nearby Simonds Distributor for hole sizes from ⅝" to 6" diameter. 6 mandrel sizes offered for light to heavy cutting. Call and try some today. Discover how "Simonds means savings whatever you cut."

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASSACHUSETTS

Buy through your local Simonds Distributor for — Local Stocks — Local Speed — Local Skill

Factory Branches in Union, N. J., Chicago, Shreveport, La., Los Angeles, San Francisco, Portland, Ore. • Canadian Factory in Granby, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.; Heller Tool Co., Newcomerstown, Ohio; Simonds Abrasive Co., Philadelphia, Pa. and Arvida, Que., Can.

CIRCLE 340 READER SERVICE CARD

WASHINGTON...

FHA for capital goods?

To stimulate modernization of the nation's metalworking plants, which has been seriously lagging the past few years, a movement is afoot to get onto the legislative schedule of the next session of Congress a plan of federal guarantee of bank loans for purchase of production equipment.

Originated by Hickman Price, Jr, Assistant Secretary of Commerce, the plan is patterned after the FHA guaranteed loan program. It would set up a revolving fund of $5 billion to be drawn upon by commercial banks in helping to finance equipment buying.

The federal insurance would provide for reimbursement of losses on loans up to 80% of the unpaid balance.

A uniform premium charge for the insurance would be made of 1% per year of the insured portion of the loan. Small shops in particular and also medium-sized companies would benefit the most from the insurance plan.

Industries that are building production equipment and firms making tools, dies and precision parts are among those that are reported to be in the process of endorsing and formally advocating passage of this credit insurance guarantee plan.

Freeze on extra Air Force funds . . .

After considerable pulling and hauling within the Pentagon, the Kennedy administration has decided not to use the extra $780 million appropriated to the Air Force to buy 45 more Boeing B-52 bombers and to speed development of North American Aviation's B-70 bomber and Boeing's Dyna-Soar boost-glide space test vehicle.

This means that production of B-52 aircraft will halt next year and that B-70 development will remain restricted to fabrication of two or three stripped-down prototype models for testing Mach 3 flight.

Defense orders booming . . .

Latest Pentagon figures on military contract awards for the current fiscal year add up to at least $24.5-billion — about 3-billion over last year's rate of new orders. Actually, the military services have been authorized to place $24.4-billion worth of contracts for "capital" purposes (production, R&D, and construction)—but some scheduled contracting is invariably delayed and carried over to next year.

In the quarter ending September 30, military contract awards amounted to over $6-billion, up about $1-billion from the previous quarter, and the heaviest rate of defense contracting since Korea. Over the next two quarters, the rate will be maintained close to the $6-billion level, then will shoot well over $6.5 billion in the April-June quarter.

Export credit aid . . .

Export-Import Bank is smoothing the way on short- and medium-term credit for US exporters. The agency plans to make export credit insurance available and to provide more direct non-recourse commerical financing on medium-term sales. EX-IM will also trim required cash payments by foreign purchasers of US goods from 20 percent of the invoice value to 10 percent.

Washington believes the new plans should put US exporters on a better footing—in terms of credit facilities—than foreign competitors. Officials say this should be increasingly important to US export sales at a time when European delivery dates are shortening and credit terms are likely to figure more prominently in decisions on where to buy capital equipment.

How liberalized credit will work . . .

A new Foreign Credit Insurance Association, comprised of 20 leading US insurance companies, will handle the liberalized export credit insurance. EX-IM, which has formed a partnership with the association, will underwrite the operations under new legislation recently passed by Congress. Details of the new insurance policies will be available in about two months when the operation gets underway.

Companies participating in the new association are mostly marine and casualty insurance firms.

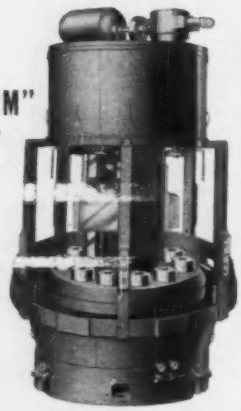
EX-IM is also bolstering its exporter credit and guarantee services to help commercial banks and other private financial institutions provide more direct medium-term export financing. From now on, banks will get guarantees from EX-IM against losses in financing exports. The hope is that such guarantees may also spur other financial institutions to finance export paper by purchasing it from commercial banks on a non-recourse basis.

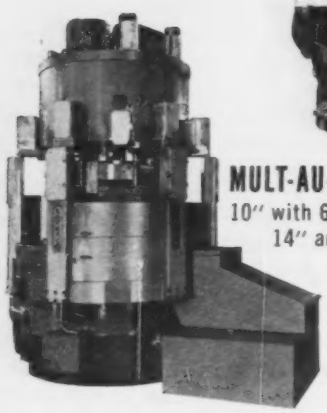
Finally, EX-IM will assume the political risk on that part of each medium-term transaction in which the normal credit risk is assumed by a commercial bank, provided the banks pays for a comprehensive guarantee for the whole period of the paper.

YOU CAN'T ....BEAT A... BULLARD..

to cut costs when cutting metal!

MULT-AU-MATIC, Type "M"
Available with 6, 8, or 12 spindles.





MULT-AU-MATIC, Type "L"
10" with 6, 8, 12, or 16 spindles, 14" and 18" with 6 or 8 spindles.

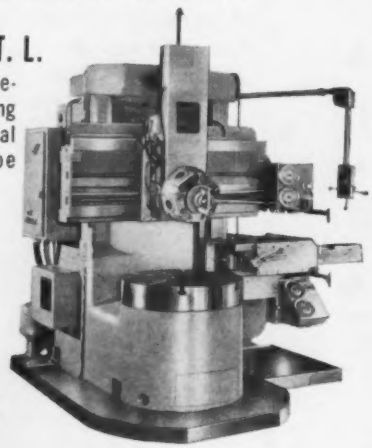
Before you buy, investigate the many outstanding features and advantages offered by modern Bullard Machine Tools.

Day-in and day-out—they are proving their ability to produce more in less time—thereby reducing the cost per piece.

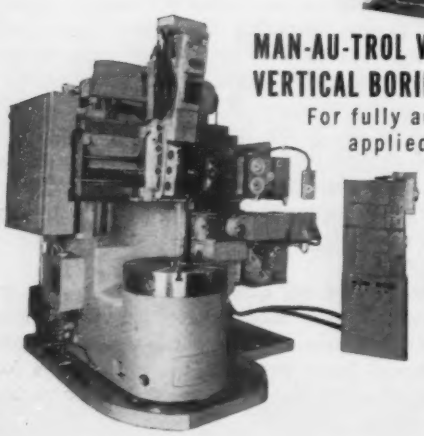
For the complete cost-saving story, call your Bullard Sales Office or write

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

DYNATROL V. T. L.
26" to 86" in 10" increments. Discrete positioning or contouring numerical control system can be applied.

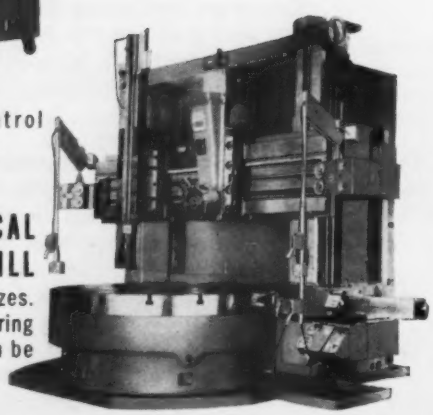


DYNAMILL H. B. M.
In 3", 4", and 5" spindle size. Many combinations of bed length, table size and vertical travel.



MAN-AU-TROL V. T. L. and VERTICAL BORING & TURNING MILL
For fully automatic operation, can be applied to any or all heads of Dynatrol at time of ordering or at later date.

DYNATROL VERTICAL BORING & TURNING MILL
108", 124", and 144" table sizes. Discrete positioning or contouring numerical control system can be applied.



DETROIT...

Auto output still climbing . . .

Total production of passenger cars in the last week of October was 159,000 units, a new high for the year, and the result of production increases practically across the board. Ford is getting back into gear; American Motors increased output something over 10%; and General Motors production is up, mainly attributable to Buick Special, Pontiac Tempest, and Chevrolet.

Both Chevrolet's Chevy II and Ford's Fairlane are now in volume production; the Chevy II at over 5000 per week in late October, and the Fairlane at over 2000 per week. Ford's strike held back Fairlane and Meteor production before announcement; and the dealer-introduction dates were set back as a result.

By corporations, current weekly production figures look like this: General Motors is pushing 80,000 passenger cars per week; Ford (still coming up from the strike low point) was turning out nearly 50,000 per week in late October; Chrysler was running around 20,000 per week; American Motors is at 10,000 per week; and Studebaker is climbing close to 3,000 per week.

Compact car sales are currently running at about 40% of the total market, and in this order: Falcon is the biggest seller, then comes Corvair, followed by Rambler Classic, Comet, Rambler American, Valiant, Tempest, Special, Olds F-85, Lark, and Lancer.

Cardinal department . . .

There's at least one ex-Swedish Saab running around the Detroit area under power from an engine intended for Ford's ultra-compact Cardinal. The small wheels (A genuine Saab's wheels pretty well fill up the wheel wells, and these don't) give it away.

The engine is a V4 (You can tell by the staggered valve covers), and it's fitted with a small air cleaner, carburetor, and distributor that look normal but midget; and the radiator is placed far forward and to the left—but without a fan.

Suspension is by a two-leaf transverse spring and a cross beam welded into the engine compartment; both of them fairly high over the back end of the gearbox. Telescoping axles run to the front wheels.

There's no guarantee the suspension will be the same in a production car (though this appears a good arrangement), but the engine and accessories look like pre-production pilot units.

According to latest reports, Cardinal engine and running-gear tooling is in good shape. The main problem has been body dies, which are now being reworked in at least one tool and die shop just outside the Detroit area.

Mutt medley . . .

One of the neatest, though shortest, assembly lines around Detroit is at Ford's Livonia Transmission Division, where just under 300 workers are putting together M-151 Mutts at the rate of 60 per 8-hr day. This is the successor to the ubiquitous World War II Jeep, a ¼-ton military utility tactical truck.

It's a real subcontracting job; engines come in from Continental (though Ford provides shell-molded nodular-iron crankshafts), the welded unit bodies are purchased, and altogether some 1157 supplier companies contribute various parts and subassemblies.

The "power unit", consisting of engine, transmission, and attached radiator, can be removed in two man-hours. Currently most of the trucks are being finished up to "stage III" specifications, which include sealing the engine, filling the gas tank and fuel system with oil, then draining the oil to allow storage over 90 days (or shipment to Europe, which is often the case).

The unit body won out over body-and-frame construction, as Ford puts it, because of lighter weight (2300-lb total), rigidity, better wheel movement, resistance to overturning, steering geometry, softer ride, and lower silhouette. But it's still a truck; and judging by a fast drive into and through a pretty lumpy trench, it can easily take more punishment than flesh can.

Tanks for "brush fires" . . .

Another current military job that runs heavily to subcontracting is the M-60 tank, now in production at the government-owned, Chrysler-operated Detroit Tank Arsenal. About the only unusual appearance items are an armored "cupola" from which the tank commander can fire a 50-mm machine gun while buttoned down, and a fat section on the gun tube, which denotes a bore evacuator; this helps circulate spent gases to scavenge the tube after a shot.

Cast armor-steel hulls and turrets come in from four suppliers. V-12 diesel air-cooled engines are provided by Continental, and Chrysler's defense plant at Scranton, Pa, builds much of the heavy hardware. The Detroit operation is mainly assembly, with some fabrication.

General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them KINATROL* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

A General Electric KINATROL drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

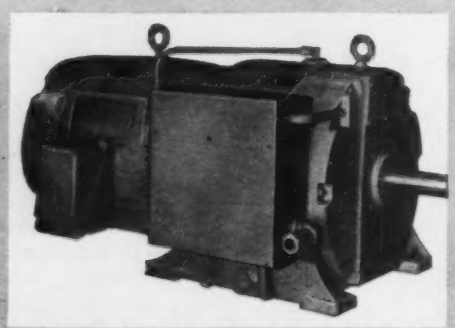
KINATROL couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

KINATROL —a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

*Trademark of General Electric Company

821-07A

AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP

AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

GENERAL ELECTRIC

ERIE, PENNSYLVANIA

CIRCLE 342 READER SERVICE CARD

AIRCRAFT and MISSILES...

TRENDS

Spinning 0.500-in. Inconel X . .

Booster nozzle jackets for one of our most advanced rocket engines are being spun from 0.500-in.-thick Inconel X in a West Coast plant. (*AM/MM*—Jul 24 '61, p4).

A 40-in.-dia rolled and welded cylinder with a wall thickness of 0.500 ±0.015 in. is spun on a Liefield P1b 1200 spinning-planishing lathe equipped with a special hydraulic power pack.

The extra power is needed at the roll to reduce the 40-in. OD to 36 in. at the throat section of the nozzle.

Five cold-spinning stages and one hot-spinning operation are employed. Starting pressure is about 40,000 psi. Diametral reduction at each stage is about ½ inch, except in the final sizing stage where little or no reduction takes place. Annealing between each cold-spinning step eliminates work hardening.

Finished wall thickness varies from one end of the jacket to the other. The flange end, for example, is thinned (from 0.500 in.) to 0.250 in., the throat section to 0.280 in., the opposite end to 0.360 in. All wall thicknesses were held to ±0.002 in., and inner contour dimensions—more critical than outside dimensions—were held to ±0.005 in.

Preliminary budget decisions . . .

The Pentagon has completed the first round in the preparation of next year's defense budget, and has come up with some preliminary decisions affecting long-range aircraft and missile procurement.

The Army has received tentative approval to begin production of long-lead-time components for the Nike Zeus anti-ICBM system in fiscal 1963.

The new budget, as it now stands, will earmark $383 million to continue Zeus R&D and to start production of critical items. This compares with $250 million to be spent this year solely for R&D.

In other tentative decisions, the Pentagon will begin development of a new tactical ballistic missile, speed development of the Minuteman ICBM railcar system, and substantially increase production of Douglas Aircraft's A4D fighter planes.

The new missile will have a range of about 750 miles—putting it somewhere between the Army's Pershing and the first version of Navy's Polaris—and will be deployed by NATO forces. No decision has been made as to whether the Army or the Air Force will manage development of the new missile.

The A4D, now being bought by the Navy as a carrier-based attack aircraft, will be bought by the Air Force for use as a support plane for Army ground troops. It will serve as the Air Force's primary ground support aircraft until the future TFX fighter becomes available.

A development contract for the TFX will shortly be awarded under a joint Air Force-Navy project.

Contract management studied . . .

Acting upon Congressional demands for better management of the military contracting program, the Pentagon is sending out teams to study the methods used by private industry.

A team from the Air Force Inspector General's Office has visited Rocketdyne Div of North American Aviation, will soon visit other aerospace plants. General LeMay ordered the visits because he was impressed by the results of the first such study made at Martin Co at the end of last year.

John H Rubel, Assistant Secretary of Defense, is heading up another study to improve both military and industry management of development programs. Robert Tucker, formerly of Hughes Aircraft Co, will attempt to improve management within the Office of Defense Research and Engineering. He recently became its plans and programs director.

Upgrading military research . . .

Dr Harold Brown, director of Defense research and engineering, has called for better management of military laboratories. He pointed to the obvious problem: How to get first-rate research on second-rate salaries?

Congressional concern over this problem will probably lead to hearings early next year on the general federal salary system and on specific steps the armed services have taken to get around it, such as establishing non-profit labs with high-paid personnel to do the military research.

Chairman George P Miller (D-Calif) of the House Science and Astronautics Committee, for example, will press Congress to provide a new pay scale for government scientists and engineers, with annual salaries up to $20,000, compared with the current $18,500 maximum allowed under the civil service system. President Kennedy is expected to give this bill (introduced in September) a vigorous push.

17.1.6

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CIRCLE 313 READER SERVICE CARD

MACHINE TOOLS...

Important buying shift . . .

An important shift in machine tool buying seems to be in the making.

The total dollar volume of new orders in 1962 may not be more than 10 to 25% better than this year's. Some big builders privately believe that overall bookings will be about the same next year as in 1961.

But the "mix" will be considerably different. Foreign sales, which have comprised one-third of the total in cutting-type machines since the first of the year, will be down. Domestic sales, on the other hand, will be up.

Latest figures show that orders booked by the Western European machine tool industry have passed the peak. They are not alarmingly off, but there is no doubt about the down trend.

The feeling is that the European order curve will level off on a high plateau.

This means that deliveries, now at an impossible 15 to 30 months, will gradually improve. As they get better, European buyers will turn less and less to American builders for their requirements.

Much of the European business that the U S machine tool industry has been getting this year is based on ability to make deliveries that European builders cannot meet.

Vauxhall is forerunner . . .

Perhaps the Vauxhall program is a forerunner of what will happen in the months ahead. At first, Vauxhall apparently was committed to purchasing virtually all of its production machines in this country for a major tooling program. Delivery was the reason.

But lately there has been a shift in Vauxhall's thinking. Deliveries promised by English builders have improved. And now it appears that Vauxhall may place a sizable portion of its purchases at home.

Incidentally, it is believed that some of the bulge in foreign orders for cutting-type machine tools in September was accounted for by Vauxhall and Ford of Germany.

What is happening at Vauxhall is likely to happen more often in European automobile circles as deliveries by European machine tool builders ease.

Little automotive buying . . .

The dearth of buying by Detroit is in sharp contrast with the well-known European tooling programs.

If U S car makers have plans for extensive machinery purchases for 1963 models, they are keeping it a secret. The truth is that many of them have not yet made up their minds what they want to do. The proliferation of models is testimony to the fact that Detroit is uncertain about what the public wants.

With any one car model having a relatively short production run and the automobile industry plagued by too much capacity, machine tool buying at Detroit promises to be modest.

But despite less-than-enthusiastic prospects in the automotive field, domestic purchases of machine tools are reported to be entering an expanding phase.

Defense tooling to grow . . .

The defense program will contribute importantly to this volume. Evidences of its effects already are apparent on the West Coast.

Around $3.5 million of machine tool orders, perhaps for the stepped-up Polaris program, is said to be about ready for placing in the Los Angeles area.

Southern California builders and distributors of machine tools report better business proportionately than other regions.

Little has been heard about ordnance tooling orders for tanks and guns in connection with the enlarged conventional warfare program. But it is known that several sizable orders are pending.

Total purchases of production equipment of all kinds are pegged at $100 million. Of that amount the Air Force will order $60 million, Army $25 million, and Navy $15 million.

Faster depreciation, via revision of Bulletin F by the Treasury Department in the late winter, is expected to contribute to increased machine tool buying as 1962 wears on.

Machine tool prices rise . . .

Several major machine tool builders have announced price increases, and many others are carefully studying such moves. Other companies report that they would like to raise their prices but are unable to justify it in view of the keen competition and slow demand at the moment.

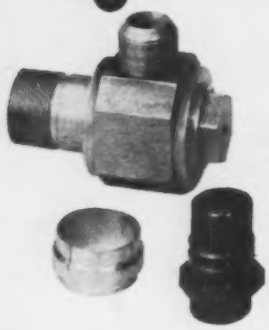
Landis Tool Co, Waynesboro, Pa, has announced a 7½% increase in prices of cylindrical and surface grinders, effective Nov. 1.

Increases planned by other builders range from 4% to 15%; some of the companies plan across-the-board hikes, but most of the increases will be on selected machines.

BF

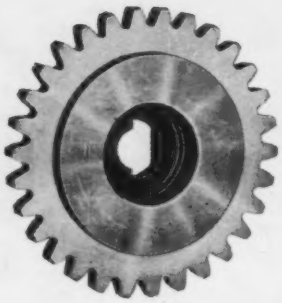
REPORTS ON RYCUT

world's fastest machining alloy steels in their carbon ranges



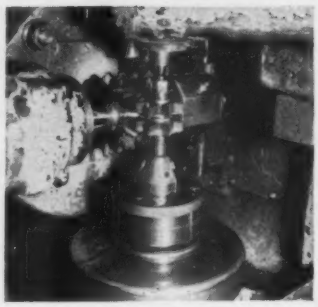
CUTS PRODUCTION COST 50% for Flodar Corp.

This manufacturer of high pressure hydraulic tube and pipe fittings reports production cost savings of 50% after switching from 4150 to Rycut® 50 and from 4140 to Rycut 40. In addition to higher production, Rycut machined to a better finish, held size perfectly and eliminated scrap loss. (With 4140 and 4150 scrap loss ran up to 30%.) And tool life, from 1 to 3 hours with the standard alloys, was boosted to 8 hours with Rycut.



MACHINES 35% FASTER for American Bosch

Rycut 40 was selected by American Bosch for this plunger drive gear for a diesel injection pump because it machines 35% faster than 4140—keeping machining costs at a minimum without sacrifice of mechanical properties. The company also found that Rycut 40 produced a better finish than 4140 and reduced down time by lengthening tool life.



BOOSTS SPROCKET PRODUCTION for McCulloch Corp.

These are the results obtained at McCulloch Corporation when they switched from non-leaded alloy to Rycut 40 for chain saw sprockets. Turning, forming, reaming and drilling operations: hourly production rate raised from 68 to 100 pieces—tool life lengthened from 3½ to 5 hours. Hobbing machine operations: hourly production raised from 43 to 65 pieces—tool life lengthened from 3916 parts per tool to 5874.

Rycut is available in a wide range of analyses: Rycut 20 is a case carburizing, oil hardening steel, with balanced composition. Rycut 40 annealed attains greatly varied strength and toughness, depending on heat treatment, making it suitable for an unusually wide range of applications. Rycut 50 annealed may be preferred (to Rycut 40) for parts with large mass or applications requiring higher mechanical properties. Rycut Heat Treated, stress relieved, assures uniform properties and machinability—carbon content is matched to bar size. Call Ryerson for any alloy requirement—and get top technical help, too.

RYERSON METALOGICS

JOSEPH T. RYERSON & SON, INC., MEMBER OF THE INLAND STEEL FAMILY

STEEL · ALUMINUM · PLASTICS · METALWORKING MACHINERY

MATERIALS...

Hardenable, non-magnetic alloy . . .

Nitinol is the name given a new alloy of titanium and nickel, as an intermetallic compound. Non-magnetic, corrosion resistant, and capable of being hardened to Rh 62C, the alloy has been tested to 43 ft-lb impact strength. Its toughness increases as temperature decreases, yet the alloy is suitable for use to 1200 F. A specific gravity of 6.45 permits use of Nitinol without adding weight to aircraft, tools, or other applications.

Furthermore, this alloy has very high mechanical vibration capacity at room temperature. However this quality decreases as the temperature is increased.

Developed by the Magnetic Materials Division of the U S Naval Ordnance Laboratory, Silver Spring, Maryland, the alloy promises benefits to a wide range of people—from the underwater demolition expert working on mines to the housewife working in her kitchen. The alloy will prove most valuable in or near salt water or in chemically corrosive environments, as well as in space vehicles.

Marked changes in mechanical vibration damping characteristics with temperature changes make Nitinol a candidate for temperature sensing devices.

Nitinol stainless cutlery may offer some competition to both stainless steel and silver. Along with holding a sharp edge, the alloy buffs or polishes to a beautiful lustrous finish that will neither stain nor tarnish. It also may have application in jewelry, auto trim, non-magnetic watch parts, and similar commercial items.

The Nitinol series consists of TiNi and its associated phases, Ti_2Ni and $TiNi_3$. The most phase-pure TiNi composition appears to be at about 54.5% nickel by weight. An ultimate strength of 124,000 psi was measured in this composition. Oxidation at 1200 F was negligible. Ti-Ni-base materials are paramagnetic with a permeability value approaching unity (<1.002), which is stable with variations in working and heat treatment.

Metal Show . . .

With more metals exhibits than ever before, the 1961 Metal Show lived up to its name and its promise. Also, there was ample demonstration that the aircraft and missile alloys are not the only metals receiving attention. While their glamour attracts attention, several commercial alloys described at the show hold far more importance for the conventional metalworking company.

Youngstown Sheet and Tube described it experimental Y-1 steel (to be available in about a year) for T-1 applications. It has a yield strength of 135,000 psi, tensile strength of 148,000 psi, and 20% elongation—and is said to have improved impact characteristics.

A spokesman for Copperweld Steel Company noted that his company was experimenting with the addition of small quantities of tellurium to leaded steel. This is a further effort along the lines of the material developed and supplied by Inland Steel as hot rolled bars with greatly improved machinability (*AM/MM*—Oct 16 '61, p. 118). La Salle Steel Company simultaneously announced La-Led-X a cold-finished, reprocessed stock starting with the Inland Steel product. With tellurium added, the steel can be machined at more than 600 sfpm, over three times as fast as B-1112, the standard screw-machine stock, according to tests at Cone Automatic Machine Co.

Vasco Hypercut, Vanadium-Alloys Steel Company's new high-speed cutting steel, can be hardened to Rh 70 C and is highly resistant to tempering. It is a specially balanced molybdenum steel with high carbon and 8% cobalt.

Copper research . . .

Research activities at Anaconda American Brass Company, Waterbury, Connecticut, will increase 10 fold as a result of the new research and technical center opened at Waterbury. Richard M Stewart, president of Anaconda American Brass, described the reason for intensified research as, ". . . influenced largely by the fact that the free world supplies of copper are more ample than they have ever been in history. Good business sense dictates that we do everything possible to develop new markets and profitable uses for copper and its alloys as quickly as possible. This was not the case until recent years."

Properties of copper of most concern to the Research Center will be conductivity, corrosion, resistance, strength, ease of working, and ease of joining. A major field of study will be the search for "stainless copper." Another area will be copper-iron alloys for internal-combustion engines. Gas-content of copper and its alloys will be a special study.

The 1960 Golden Anniversary annual report of Norma-Hoffmann Bearings Corporation, Stamford, Connecticut, outlines the impressive progress resulting from their long range capital improvement program. By the careful selection of reliable capital equipment compatible with a comprehensive quality control system, Norma-Hoffmann customers are assured of a consistently fine quality product.

AN INDICATION OF PROGRESS AT NORMA-HOFFMANN

. . . Bryant Centalign® Grinders

Important factors in progressive statistical quality controlled production are the Bryant Model "C" Centalign Grinders shown here in the Norma-Hoffmann plant. Straight bores and precision bearing raceways are ground on the Centaligns with consistent accuracy . . . at record-breaking production rates.

Progressive manufacturers throughout the world are improving their competitive position with Bryant Centaligns. Engineered for quick changeover and minimum down time, every one is thoroughly "proved out" at Bryant by statistical quality control methods. Find out how a Centalign Internal Grinder can help you.

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CIRCLE 345 READER SERVICE CARD

WHAT'S AHEAD... in Metalworking

TRENDS

Holding steady at near-record levels . . .

Metalworking production continues to gain slowly but steadily on a wide industrial front, bearing out expectations that it will hit a new peace-time peak between now and year's end.

The slow but widespread gain is paced by the consumer goods industries. The pickup has been slower in the basic metalworking industries.

Even the nation's steelmakers, whose output rate has been somewhat static, are optimistic. Though the pace has been far from feverish, automotive orders aren't coming in as they should, and the November outlook is far from lively, steelmakers are optimistic.

It is now believed that 1961 steel ingot production will run to about 100-million tons—about 103 on the industry's 1958-59=100 index. The big jump is expected next year. It could be anywhere from 10% to 15%.

At the moment however, lack of inventory rebuilding is holding back production of steel. Industry spokesmen don't look for any inventory buying of consequence before first quarter 1962.

When consumer inventories do switch from liquidation to accumulation, the inventory buildup will be the result of better business, and will not be because of hedging against a strike.

Here's how the steelmakers look at 1962: the first half will be colored by inventory building, then orders will take a pretty good drop in the third and fourth quarters. But the year as a whole should run as much as 15% higher than total 1961 tonnage.

Sheet metal shops are agreed that this will be a good year. Third quarter business was "good but not outstanding." Even so, the industry looks forward to a 10% gain this year over last.

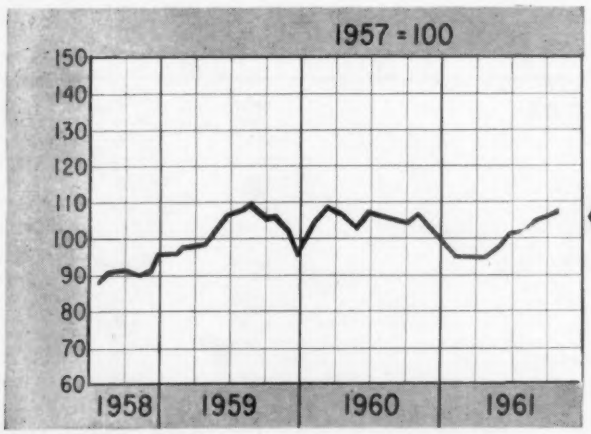
Metal stampers admit that this year's start was too slow to make 1961 a really big year for them, but business has been picking up steam all year and the fourth quarter should show a big upswing.

Metalworking job shops are divided among the "have" and "have nots." The "haves" are tied to the booming consumer and construction industries, while the "have nots" are dependent upon the more basic metalworking industries.

Commercial heat treaters report that good-sized orders have been coming in in recent weeks—especially from the automotive and appliance industries. The pickup is expected to continue through the fourth quarter and beyond.

Contract tool and diemakers report signs of a pickup, although business to date hasn't shown any decided upturn. It's been a slow year for the industry as a whole, but shops are confident that orders will increase in the fourth quarter. One especially good sign for tool and die shops: Backlogs have been improving steadily since midsummer.

Drop forgers report continued business improvement across the board. Encouraging signs early this fall have translated themselves into a decided pickup, which is expected to last at least through the rest of the year and should bring 1961 totals up to last year's levels.

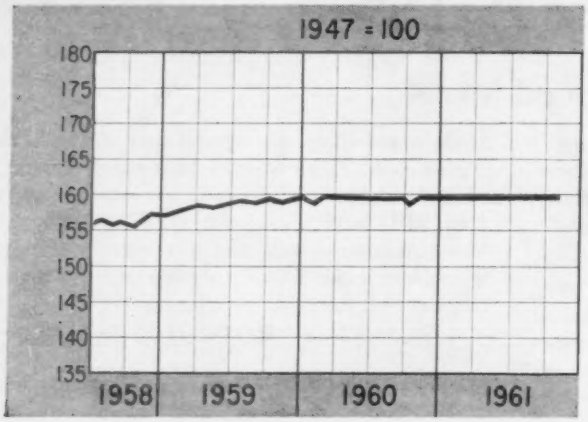


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	OCT Estimated	SEP Preliminary	AUG Revised	SEP Year Ago
Total Index	**105**	**103**	**107**	**107**
Machinery		101	102	106
Electrical Machinery		116	118	112
Autos		96	115	117
Other Transportation		93	90	89
Other Metalworking		109	113	109

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	OCT Estimated	SEP Preliminary	AUG Revised	SEP Year Ago
Total Index	**159.5**	**159.4**	**159.4**	**159.4**
Metalworking Machinery	194.5	194.0	193.3	
Other Machinery exc. Electrical	174.2	174.2	173.1	
Electrical Machinery	156.6	156.7	158.7	
Fabricated Metal Products	147.1	147.1	145.2	

Holding the price line . . .

With an extremely rapid recovery from the recent recession under our belts and the prospect of further large gains in business, the question of the outlook for prices comes to the fore. For the businessman, of course, that means industrial prices.

Prices of industrial materials, on the average, have been drifting slightly lower since late 1959. A rise in the manufacturing operating rate from 77% of capacity in December, 1960, to 81% in September of this year has not nudged prices one bit higher.

From here on, however, the prospects are slightly different. Plant operating rates, though still not into the mid-ninety percent range, are climbing rapidly. Thus the possibility of inflation, particularly in the producer's durable goods lines has occurred to many analysts.

But a recent survey scotches the idea of big price hikes for capital equipment. The McGraw-Hill Economics Department asked capital goods purchasers if they were expecting price changes between 1961 and 1962, and the reply was an average rise of less than 3%.

Remember, though, that it takes both a buyer and a seller to strike a price bargain. The same men who saw only a 2.6% price rise in capital equipment for the coming 12 months also foresaw only a 7% increase in their capital spending.

That estimate may be too modest. When business is on the upswing, spending plans are often on the low side, and the impact of government spending may be greater than now anticipated. If Mr. Khrushchev continues to turn on the gas under political pots all over the world, Washington will be in the market for an increasing variety of hard goods, many of which will require new machinery to produce them.

Monetary policy is another important element in the price outlook. Mr. Kennedy favors an easier money policy than his predecessor in the White House. Therefore, he may be willing to accept some inflation to stimulate economic growth.

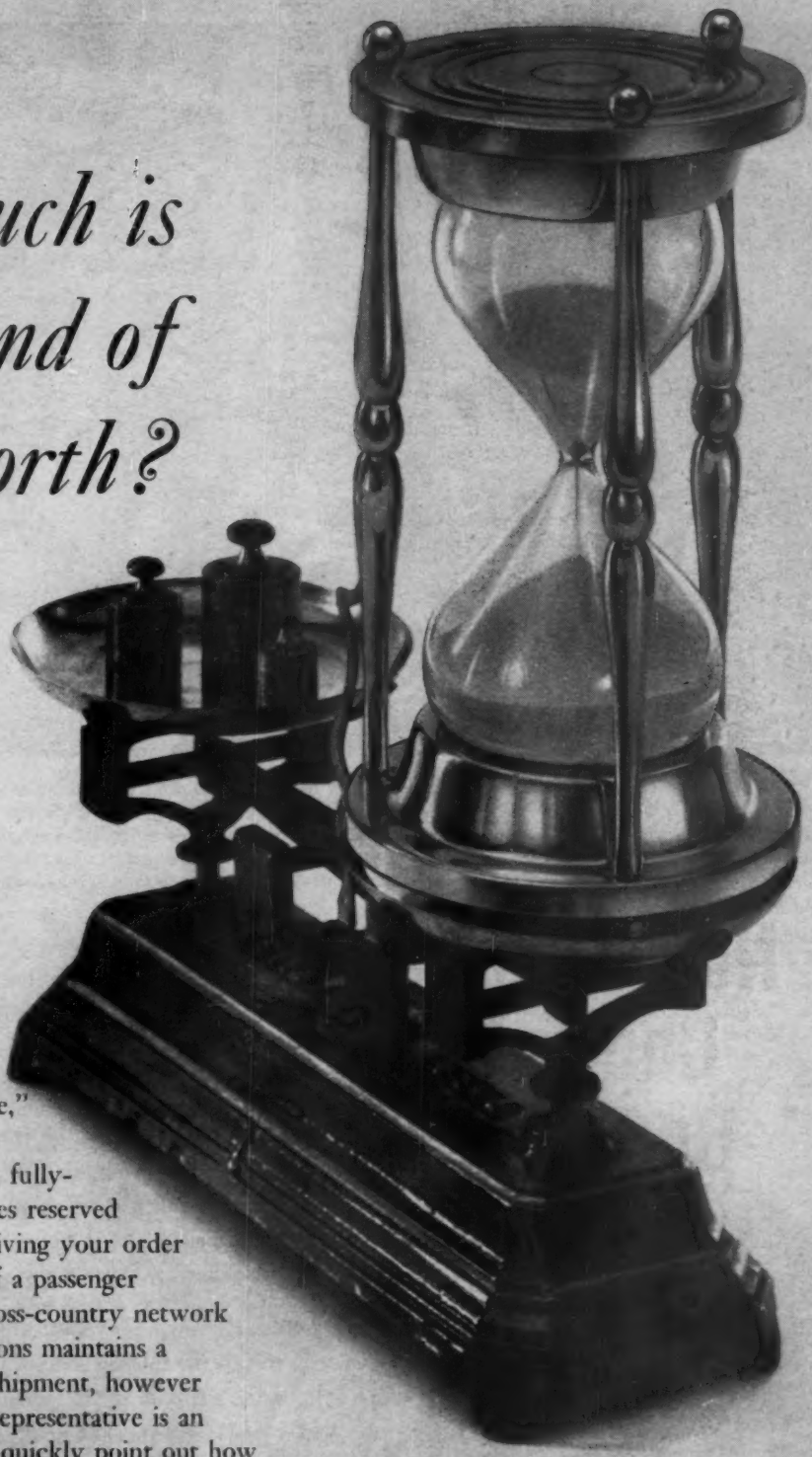
WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	161.7	159.7	146.7
Steel ingot production (thousand tons)	2,057	2,042	1,545
Electric power output (million Kilowatt hours)	15,263	15,162	14,271
Production of automobiles	161,278	143,150	150,019
Engineering construction awards (*Eng. News-Record,* thousands)	$81,066	$77,877	$65,256

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	305	353	291
Vacuum cleaners sales (thousands of units)	214	242	223
Washers sales (thousands of units)	182	239	175
Household electric ranges sales (thousands of units)	57	70	57
Radio production (thousands of units)	659	1,088	955
Television production (thousands of units)	376	614	269
Gear sales index (1947-49=100)	219.8	220.0	217.5
Foundry equipment new orders index (shipments, 1947-49=100)	69.0	130.8	80.0

* Seasonally adjusted

CIRCLE 346 READER SERVICE CARD ▶

How much is a pound of time worth?



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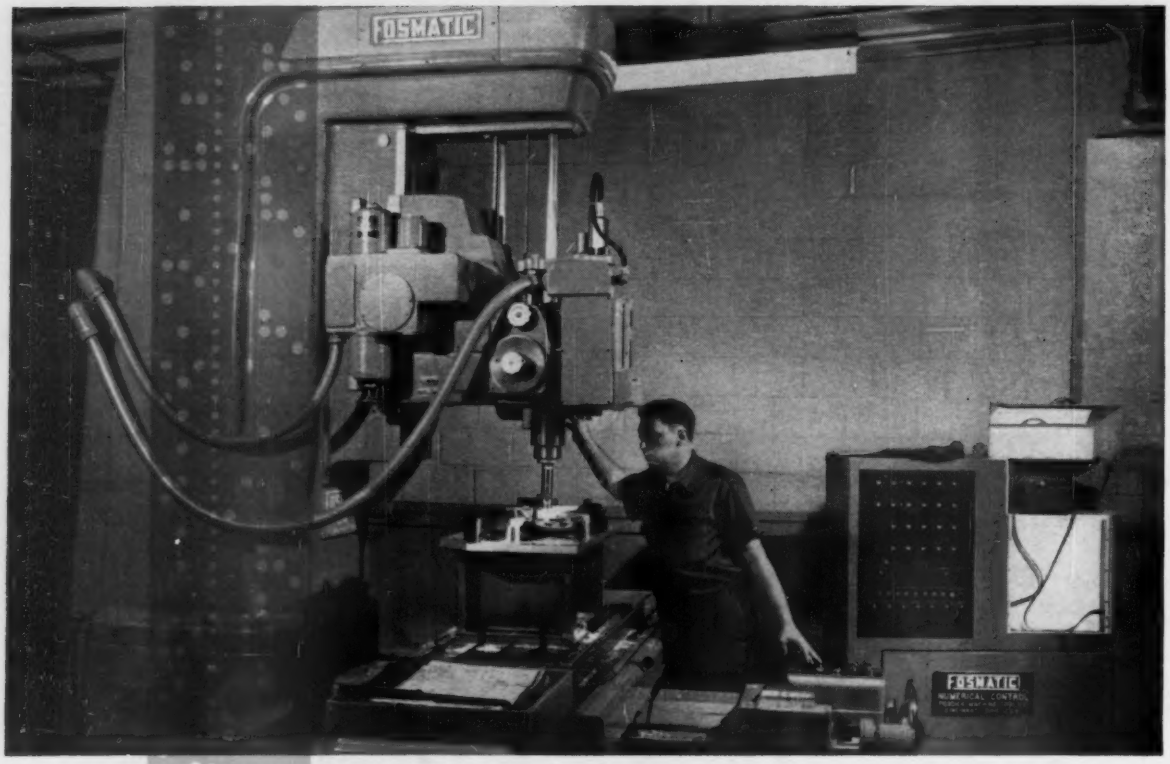


Pioneering in a new style job shop specializing in numerically controlled machining is Numerical Machining Inc. (NuMac). This Cleveland shop keeps the above model 54-p Fosmatic N/C Jig Borer plus three other N/C machines busy with a constant flow of rush work. NuMac grew out of Industrial Enterprises Co., a conventional machine shop drawing most of its business from a 30 mile radius. Now NuMac draws business from 3,000 miles!

Numerical Control Bonanza

Golden opportunity awaits the shop that makes a specialty of numerical control! It's suited to almost any small lot job which can be mathematically described. N/C is a real money saver and a money maker!

You can open this rich vein with a Fosmatic Jig Borer or Numerically Controlled Drill, both directed in all three axes by tape control. You'll realize faster precision boring, drilling, tapping, and milling at the punch of a paper tape. You'll also be able to offer lead time cut by weeks, engineering changes implemented in hours, tooling costs cut by thousands to justify your investment.

Take a tip from fast-growing Nu-Mac of Cleveland and be the first shop in your territory to tap the mother lode of numerical control. Write today for Fosmatic bulletins PBM-A (N/C Jig Borers) and TD-A (N/C Drills). Better yet, "get a proposal from Fosdick!"

FOSDICK

The Fosdick Machine Tool Company, Cincinnati 23, Ohio

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

All Shook Up

The "compact" revolution has shaken Detroit right down to its toes.

Remember when the automotive boys pooh-poohed the rise in sales of foreign cars? It was only a fad, they said. Silly to pay attention to it. The whole thing would blow over.

So they went on building bigger, longer, more powerful and higher-priced cars, that is, all except George Romney with his Rambler. It wasn't until they could no longer sell them, and the import volume got larger and larger, that they woke up.

Then the Corvairs, Falcons and Valiants came into being. And almost before we knew it, there was a Pontiac Tempest, a Buick Special, a Dodge Dart, a Ford Comet and an Olds F-85.

The long-established pattern . . .

of price ranges of cars suddenly collapsed. And a new one sprang up that started farther down and had many more choices in the lower brackets.

The result of all this is that the entire automobile industry is "all shook up." It doesn't know quite what to make of it. No longer does any single car have the tremendous production and sales volume of former days.

More models by far are being built than ever before. But the industry's overall production is no greater. Each maker thus has to be content with lower production runs and is forced to base his costs on them.

No one knows, least of all Detroit's automobile chiefs, how long this situation will persist. It may go on permanently, without any return to simpler, easier-to-cope-with conditions. It calls for quick thinking, flexibility by management and eternal vigilance in watching costs.

Though the "compact" revolution is the most spectacular example of what's happening in American industry, its counterpart is to be found in such products as home appliances that are sold through discount houses as well as through department stores and independent retailers.

Lets face it . . .

American consumers are price-conscious. And their concern about prices will deepen rather than relax as inflationary economic forces make themselves felt. Management therefore cannot afford not to be price-conscious if it wants to stay competitive.

Makers of consumer goods, however, have no monopoly on price-consciousness. It permeates all of industry, from small tool and die shops to companies building the heaviest of capital goods. The inexorable rise in the cost of doing business is responsible for it.

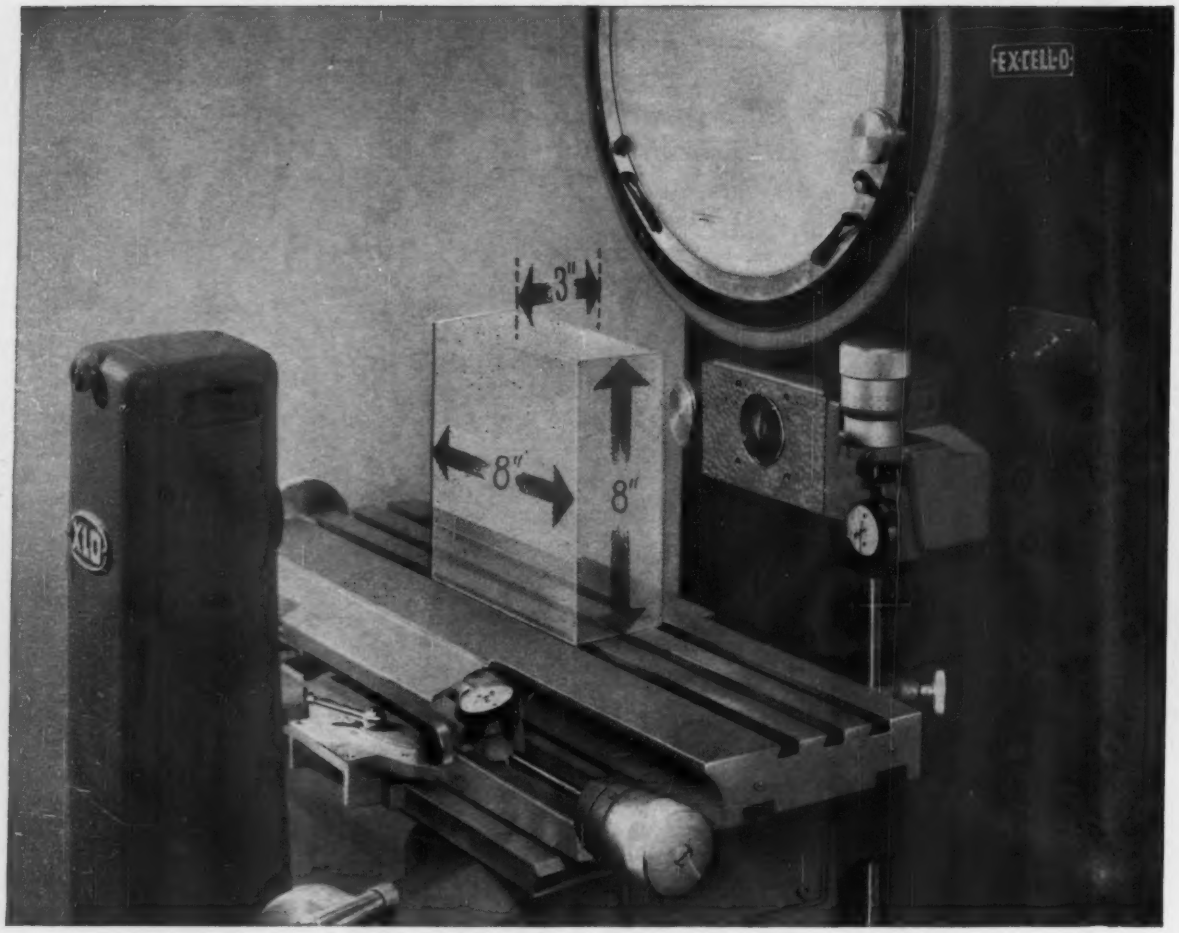
This fact of life . . .

gives special urgency to the never-ending need for cost reduction. For price-consciousness and cost reduction go hand in hand. You cannot have one without the other.

The two are in the forefront of Detroit's thinking as a result of the "compact" revolution. They will be dominant in management's thoughts in other industries, too. They will be all-important throughout Metalworking.

In making your plans for the next few years, you should give them top priority.

Burnham Finney EDITOR



EX-CELL-O Contour Projectors Give You 98% More Capacity

Ex-Cell-O Models 14-5 and 30 give you capacity to accept and optically gage much larger parts than is possible with other contour projectors,—*and without repositioning on the table!*

A full 8″ of table travel in both horizontal and vertical planes, together with 3″ of focusing travel is standard on these Ex-Cell-O Models. Every point within this "block" can easily be brought into focus on the screen.

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Stainless chemical milling goes on the line

Long researched by many companies, chemical milling of stainless steel — to fine tolerances — is now a production reality. Here is how a major aircraft builder controls the many variables that make stainless so hard to etch

By Tom Johnson, associate editor

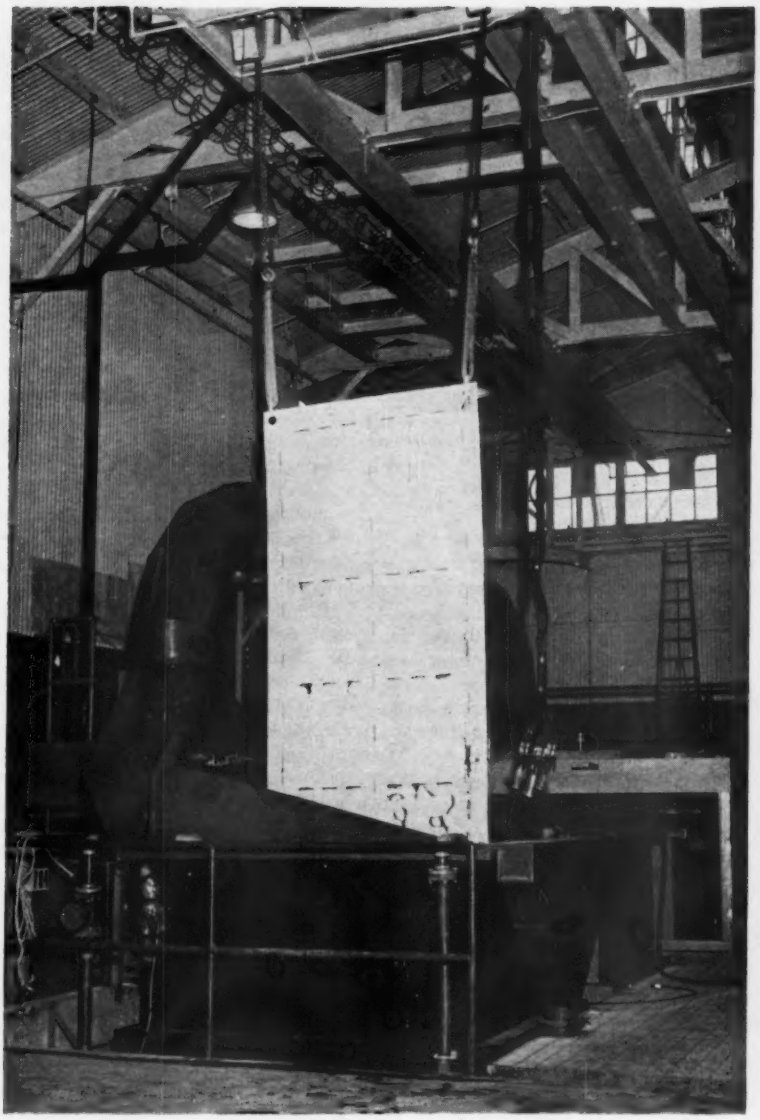
Chemical milling of stainless steel, long considered one of the trickiest etching processes to control, has come out of the laboratory onto the production floor.

Here are some statistics that show the significance of the breakthrough:

- Stainless parts are consistently etched to within the ±0.005-in. tolerances that company designers normally specify. On individual jobs, special handling can hold tolerances even tighter.
- Surface finishes of 35 to 50 micro-in. rms are regularly obtained on cuts as deep as 0.080 in.

This is the achievement of the Grumman Aircraft Corp, where six process engineers and fifty production workers in the Chemical Milling Section are now kept busy turning out stainless and aluminum parts for Grumman and outside agencies (chiefly missile fabricators). At Bethpage, NY, a new line for chemical milling of stainless supplements Grumman's aluminum chem-mill line, largest on the East Coast.

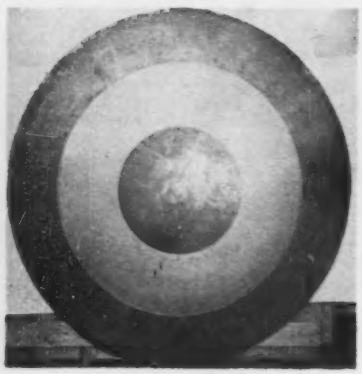
The big news here is the consistency of the operation. Frederick P Scott, process engineer in charge of chemical-milling development on laboratory and pilot lines, explains: "We've been able to meet design



Chemical-milling line includes three large tanks with elaborate heating and exhaust systems. In foreground, large stainless sheet is being lowered into etch tank, which holds 3000 gallons of special acid mixture

Stainless chemical milling goes on the line

Pilot line is located near production line. Each type of stainless that is milled requires its own special etching solution. In the pilot line, technicians can try out new solutions



Typical etched stainless part is this component for a pressure vessel, which has been chemically milled to within ±0.005-in. tolerances specified by designers. Material here is stainless 17-7

tolerances for stainless parts just as consistently as we meet the somewhat closer tolerances specified for aluminum. And specifications are getting tighter all the time. In the near future, we're tackling a large job that calls for tolerances to ±0.003 in. We expect no trouble."

As in the chemical milling of aluminum, the big advantage is weight reduction that on many parts—especially stainless sheets—cannot be obtained in any other way. Designers can now specify tapered and contoured surfaces on stainless sheet by chemical milling, which will in most instances lower production costs and improve reliability. To the tolerance and weight conscious aircraft and missile industry, the new line offers new design freedom.

Physical setup

Grumman's new prototype production line includes three steel tanks, each with an exterior size of 6 by 6 by 12 feet. Cleaning and rinsing are performed in two of these and etching in the third. In the etching tank, which is lined with polyethylene and Penton, the heated solution that does the chemical milling is kept at an 11-foot level. Usable working space is 4 by 4 by 8 feet.

Stainless currently being etched includes AISI 321, as well as precipitation-hardening stainless 15-7 and 17-7.

An elaborate heating system keeps the solution at exactly the temperature required for the milling operation. To protect workers, an equally elaborate exhaust system removes acid fumes.

During the etching process, control of the solution is critical. To help production people know what to expect with each type of stainless alloy, Grumman has built nearby a fully equipped pilot line. Here researchers can duplicate the conditions that might occur in the larger line. They can investigate in miniature all the variables that affect the chemical milling of stainless: ion concentration, acidity, rate of etch, temperature. In the pilot line, laboratory technicians can make analyses of the solution in the big etch tank, to find if it is still within the critical working limits that give the best results.

Problems with stainless

With stainless, almost all the ordinary problems of chemical milling are intensified. The following factors help explain why etching of stainless is so difficult, compared to the better-known chemical milling of aluminum:

• **Each stainless alloy normally requires its own special solution.** And each solution has its own set of critical working limits. The range of aluminum alloys that a given solution will chemically etch is much broader.

• **Surface finish is hard to control.** In the etching solution there must be, within certain limits, the proper relationship between ion concentration and acidity. Under ideal conditions, it is possible to get a better surface finish than with aluminum. But as the solution evaporates, or changes during the milling process, surface finish can deteriorate.

• **Etching may be uneven.** Two phenomena of chemical milling are especially hard to control on stainless parts: (1) There may be "dishing," in which the etched area is concave rather than flat. (2) "Channeling" may occur: When the concentration of nitrate ions is not right, or if there is excessive agitation of the solution, a trench appears on the periphery of the cut.

• **Hydrogen embrittlement is always a possibility.** With aluminum, of course, the problem does not exist. Baking those metal parts that are subject to hydrogen embrittlement after etching can alleviate this condition.

• **The surface of stainless may be passive.** Here the surface will not react to the acids in the solution. To correct for this surface passivity, it is necessary to dip the stainless part in a pickling solution for a few minutes.

• **Scale removal is difficult.** To prepare aluminum for etching, the only problem is to remove grease and dirt; aluminum oxide offers no resistance to the milling solution. But on stainless there is often a thin scale of heat film that must be removed. Normally, a commercial solution removes this film, but some-

times it is necessary to resort to vapor blasting.

Process in detail

Obviously, successful chemical milling of stainless parts calls for the most careful handling and control. To see how Grumman consistently etches stainless to fine tolerances and surface finishes, let us examine the entire production process closely.

When stainless comes in for milling, holes are first drilled in four corners, so that fasteners can be inserted to hold the part when it is dipped into the tanks. There is always excess material on the edges of incoming stainless—not simply to provide space for the holes. Edges are very difficult to etch evenly during the process, especially if the stainless is thin sheet. After processing, the part gets cut to size.

Next a very careful examination of the part is necessary. There should be no pits, scratches, and blemishes, because etching tends to exaggerate defects that are present. Because the part has usually been partially fabricated in the machine shop, it has been subjected to much handling—and the possibility of mishandling.

Now an inspector gages the part ultrasonically. The object is to get an overall picture of the part's condition, also to find the thinnest section. During chemical milling, everything will be geared to the part's thinnest section.

If there is any scale on the part, it must be taken off. Normally Grumman tries cleaning the part with a commercially available solution. If this doesn't work, the part is vapor-blasted—subjected to a mixture of fine silicon grit, water, and air. Such a cleaning technique is superior to sand blasting, because it doesn't change the part's surface characteristics.

Coating with neoprene

To avoid contamination, the part now goes immediately to be coated with neoprene. Grumman prefers to apply neoprene by the flow-coat technique, rather than by dipping or spraying.

Flow-coating involves suspending the part above a long, shallow tank, filled with neoprene, that is fitted with hoses through which neoprene can be pumped. Directing the hoses at the part, workers flow the neoprene over it, coating both sides.

After one coat, the neoprene tends to be thicker at the bottom of the part than on top. To get an even thickness, the part is reversed 180° (after the neoprene sets), then given another coating. This process continues, usually for three or four coatings, until a thickness of 8 to 10 mils builds up. Such a thickness makes it easier to remove the neoprene by hand later.

Once the coating is on the part, it must thoroughly air dry. This allows any entrapped solvent to evaporate, so that bubbles won't form during the baking that comes next. The coated part then goes into an oven, where it is baked for about 1½ hours at about 300 F.

Now the part goes to the Chemical Milling Department, where "scribe and strip" men prepare it for the milling operation. Placing a templet on the coated part, they scribe with sharp knives the areas to be etched. Then they strip out the neoprene from these areas by hand.

The etching operation

Attached to a rack, the part is now ready for milling. Suspended over the etch tank, it is slowly dipped into the tank and held there until completion of chemical milling.

If small enough, the part is suspended in the solution at a 45° angle. This prevents irregular etching, caused by bubbles from the chemical reaction that adhere to the part's surface. If the part is a large one it hangs vertically, but must be turned 180° at least once (preferably several times) during the process to avoid the harmful effect of the bubbles.

The time that the part remains in the solution depends on the etch rate, which has been calculated in advance. This rate of etching varies from 0.0004 to 0.001 ipm.

As a check on the rate of etch, the part can be removed from time to time for ultrasonic gaging of thickness, revealing how much more material needs to be removed from etched areas.

Normally, the part is immersed in the solution for the pre-calculated time period, then is removed. If step etching is being done, that is, if several depths are being etched, the part must be removed from time to time for unmasking certain areas. The areas that are to be milled to the least depth are, of course, the last ones that are unmasked.

Now the etched part comes out of the solution and goes through a water spray, which rinses it thoroughly. At this point the remaining neoprene is ready to be taken off. To facilitate this, the part passes through a solution (an organic one, chiefly methylene chloride) that breaks the bond between the neoprene and the steel. Following this treatment, workers strip off the neoprene by hand. Next the part goes through another solution, which removes noeprene stains, as well as hand and holding-hook stains.

Finally, the part undergoes inspection, then is sent off to have the edges cut to size.

Makeup of solution

The solution that does Grumman's chemical milling of stainless is basically a mixture of hydrochloric, nitric, and phosphoric acids. The etching tank holds 3000 gallons of this powerful mixture, first formulated by North American Aviation and later licensed to Turco Products.

Such a raw solution is too unpredictable to do precision etching of such a hard-to-control metal as stainless. To prepare the solution for use, Grumman had to take a time-consuming step: For every gallon of acid, about one pound of stainless was dissolved in the solution.

Adding so much stainless accomplished several things. It reduced the acidity of the solution. It added iron, chromium, and nickel, which the solution must contain before it will react as desired. Finally, it brought the solution close to the critical limits—the proper balance of ingredients—under which the etching process works best.

This sizeable mixture of stainless and acids needs to be altered slightly for each different alloy that is etched. Prior to the operation, tests in the laboratory show what changes are necessary to bring the solution up to critical working limits for the particular alloy. This may involve such additions as iron, chrome, or nickel chloride or nitrate.

In non-chemical language, what happens during the etching process is that hydrogen leaves the acids and changes place with the stainless. As a result, the solution constantly has metal added to it and hydrogen depleted from it. Too, the hydrogen reacts with the nitrate ion. About ¼ pound of steel for every gallon of solution can usually be dissolved before the critical working limits of the solution are affected. After this, the solution must be readjusted by adding more acid. Tests then show what is needed to bring the solution back within the critical limits that produce reliable etching of stainless. •

Technical program, exhibit highlights

Report on 1961 Metal Show

Diemaking will remain the major application for electrical discharge machining even though the power output of EDM units will increase significantly in the near future, predicted D H Hill of General Motors at the 43rd National Metal Show in Cobo Hall, Detroit, October 21-27.

There is a practical limit, he said, to the amount of stock that can be removed by EDM. Both metal-removal rates and wear ratios should improve considerably in the near future; in accuracy, the method already rivals jigboring. But EDM is not a natural for mass-production techniques, and will probably always be reserved for diemaking, special cutting problems, and machining of extra-hard materials. The number of applications, however, will continue to expand, he said, as more people learn what it can do and how to put it to work.

Largest electrolytic unit

A 10,000-amp electrolytic machining unit, the largest of its type yet reported, was discussed by L A Williams of Anocut. This giant is designed to handle parts up to 60 in. in diameter. Williams noted that Anocut has achieved cutting rates as high as 1 cu in./min, but pointed out that this was on a "good day," and wasn't a likely cutting rate. A removal rate of 0.250 cu in./min was cited as more normal.

The Anocut technique has recently been used for turning and internal broaching jobs. One part, an extruded angle shape, was thinned by feeding it between two shaped tools to a web thickness of 0.020 in.—a job that milling just couldn't do.

Another part was a flywheel shape on which the web had to be thinned to 0.006 in. This was impossible by normal cutting-tool action; a grinder took 20 minutes to do the job. In a lathe-like setup, electrolytic machining thinned the part to size in just 20 seconds.

Vacuum brazing

Several tricky assembly problems have been solved by vacuum brazing, reported T H Crane of Kinematics Corp. One example was an artificial heart built up from Type 304 stainless steel tubes and baffle plates. Problem here was to braze the tubes to the plates without leaving any cracks in which dirt could collect, for the unit had to perfectly cleanable.

A holding fixture was completely dipped in white stopoff before the parts were assembled. After brazing, the assembly was cleaned ultrasonically in three baths. Cooling took six hours, but introduction of 0.1 micron of argon when the assembly had cooled to about 800 F speeded the cooling by improving the heat transfer rate.

Welding methods for titanium

In a paper on the fabrication of titanium, P J Rieppel of Battelle Memorial Institute discussed four welding processes that should be particularly valuable in joining this material, though very few applications have been reported so far. The processes are ultrasonic welding, magnaflash welding, stud welding, and high-frequency welding. All of them avoid, to a large extent, the cast structure that causes problems in welding titanium.

Among the features that these processes have in common are compressive loading, or upsetting, and no filler metal. Too, the energy gradients away from the surfaces being joined are so steep that almost no heat-affected zone is produced in the base metal.

Solid-state bonding is another promising technique, he said, because it too avoids the cast structure —the work is performed below the melting point of the workpieces— and because solution-annealed alloys can often be bonded at their age-hardening temperatures.

New equipment on display

• Leeds & Northrup introduced a new multi-control system for gas generators, batch furnaces, or heating zones of continuous furnaces. It measures and controls CO, CO_2, or CH_4, adjusting the flow of enriching gas to conform to preset limits for protective atmosphere heat treating.

• A motor-generator induction heater shown by Anderson Engineering has 15 kw capacity yet weighs only 850 lb, takes little floor space, and is priced 40% below other heaters in the 250-3500 F range.

• General Electric's Lamp Division announced that tungsten sheet two feet wide and up to 96 in. long, in thickness to 0.150 in., would be available in six months, possibly sooner. At the moment, 12x12 in. is the maximum size sheet available. The larger sheets are expected to find application in missiles and high-temperature furnaces. Because GE has rolling capacity for the new sheet sizes, it expects to follow up later with sheet molybdenum in the same size ranges.

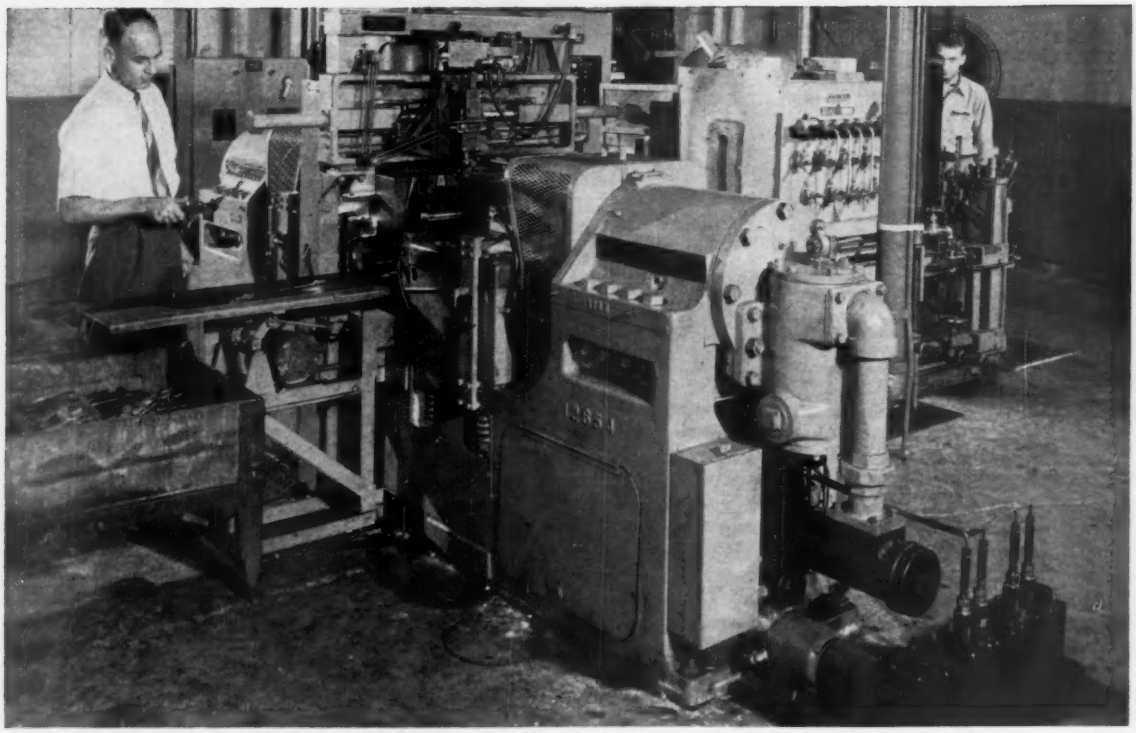
• In the welding line, Lincoln Electric demonstrated an improvement on the Squirt semi-automatic submerged-arc welder: a 10-lb drum and air feed system replaces the usual flux delivery cone. A new tractor for tandem submerged-arc welding doubles tandem welding speeds. It operates at 6 to 96 ipm and includes welding controls.

Developments in plastics

At a symposium on plastics applications, G L Graf, Jr of DuPont Co described several cases where Zytel and Delrin can compete with zinc die castings as well as aluminum and brass—usually applications where there is a medium to large amount of finishing required. High-density polyethylene, at 32¢ per lb, can replace sheet steel, at 7¢ per lb, if the finish required is more than a simple coat of paint.

A fluidized bed that applies a coating from 6 to 50 mils thick on metal parts was described by W R Pascoe of Polymer Corp. Parts heated to the melting temperature of a powdered thermoplastic are immersed in the bath, which acts as a liquid because air blown in through the bottom lifts the particles and makes them slide on each other. Speed is the main advantage. It takes but a few minutes to heat the parts, ten seconds for the dip, and a minute of two for post-heating to assure even plastic flow.

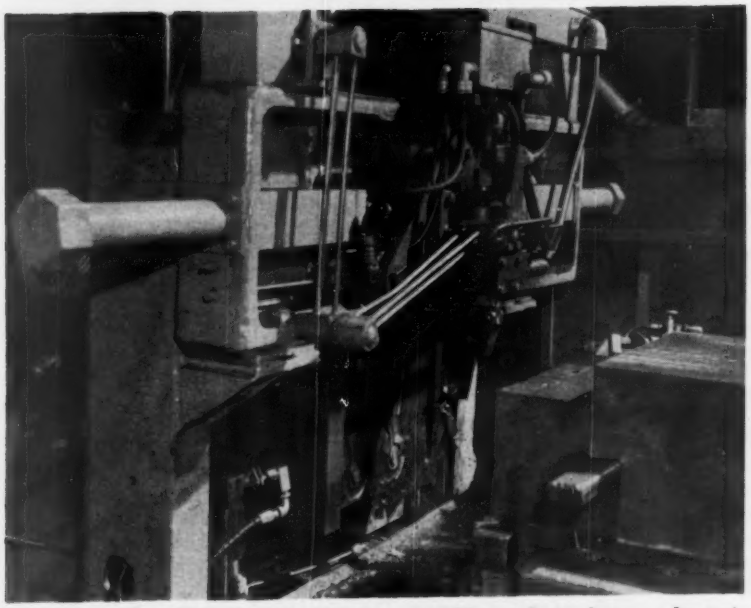
This year's Show had more exhibits and took more floor space than the '60 Show in Philadelphia; it featured 267 technical papers and 62 technical sessions. Cooperating with the American Society for Metals were the Metallurgical Society of the AIME, the Society for Nondestructive Testing, and a number of industrial trade associations. •



Impacter operates horizontal impellers (rams) to forge parts held by mechanical tongs which index along slide. Valving in right foreground is for air supply that drives impeller. Selas bottom-slot furnace (right) heats blanks to 2200 F

IMPACT OF AN IMPACTER

Tailoring a shop to a machine



Tongs center blank between mating dies for counterblow, indexing between die cavities after required number of blows at each station

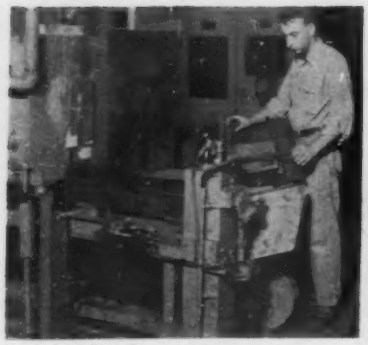
Rarely does one automated machine spur modernization of an entire shop. Here's the exception, Clauss Cutlery Co, which now claims the world's most modern cutlery facility

By Charles Emerson, Detroit Editor

A single machine has started a minor industrial revolution at an oldline Ohio cutlery company. It all began when Clauss Cutlery Co of Fremont installed a highly automatic Chambersburg Model C Impacter to boost its production of scissors and shears.

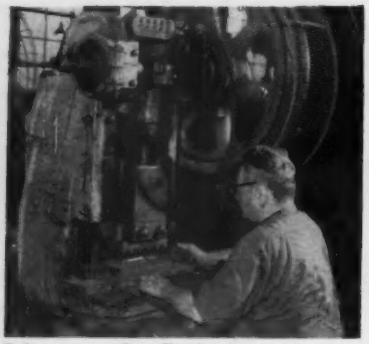
The Impacter (an almost automatic forging machine that drives two matching dies together in the horizontal plane, and which is equipped with mechanized tongs that center and locate the heated blank accurately between the dies) has since proved so efficient that the company has completely upgraded

Here's what Clauss bought to keep pace



Bottom-slot furnace

Electrical discharge machine



Trim press for flash removal

its accessory equipment to keep pace with it.

As a result, the company now claims to have the world's most up-to-date cutlery facility, one which has doubled plant capacity without any appreciable increase in floor space requirements.

To go with its Impacter, Clauss has acquired new electrical discharge machining equipment for die making, vibratory and tumbling equipment, heat treating and quenching facilities, and blade-grinders.

Behind Clauss's revamping lies a determination to compete against imported shear products—even at a 5 to 1 price disadvantage. Not only that, with its new setup the company can also branch out into new products, and forge components for other companies.

Clauss expects to retain its skilled labor force, regular board-drophammer operations, and its flexible hand and mechanized finishing operations —combining them with the new setups to achieve lower costs and increased output.

Impacter advantages

Clauss's new Model C is a universal machine, based on Chambersburg's earlier (1952) Impacter but not restricted to a single, mass-produced product. It has mechanized work handling, automatic blank heating, and electric programming controls that allow fast changeover (less than an hour for two setup men) to another part design.

The machine works with equal, opposing counterblows—thus needs only a heavy concrete floor to support it instead of a special heavy foundation.

Operating at a faster cyclic rate than a drophammer (up to 180 blows per minute), the Impacter delivers parts with high regularity, and produces less noise than standard forging equipment.

Product quality—judging by the several hundred thousand parts of a half-dozen different designs produced to date—is higher than that which can be achieved by normal drophammer forging. One reason: automatic control and compensation detects off-center blows and recenters the impellers.

This means that blows are on-center at all times, less allowance has to be made in blank size for mismatch and, consequently, blanks can be smaller and there is less flash on forged parts.

Work handling and indexing within the machine itself is electrical and hydraulic. A pair of mechanized tongs keeps the blank accurately centered at each die station (there may be three or four stations).

Useless flash can be reduced 10% or more, which means savings not only on raw stock but later on during finishing operations. And matching contours on both sides of the forging are accurately aligned.

Forging capacities range from 600 to 1000 parts an hour, depending on the size of the work and the complexity of the forging operation.

Scissor blanks vary from ¼ to ⅜-inch thick, and are up to 12 inches long. Other parts can be formed from round stock up to a 1 inch diameter, and to a weight of 2 lbs.

Impacter operation

Basic equipment for the forging machine includes a radiant gas-fired furnace, a conveyor that feeds stock through the furnace, a transfer mechanism that shifts parts from the furnace conveyor to the Impacter tongs, and a discharge vibratory conveyor.

Blanks are heated to forging temperature (up to 2200 F is required) at a rate of 18 per minute for the smallest sizes, and 9 per minute in the largest, in a Selas bottom-slot, water-jacketed furnace.

A unique conveyor system picks up blanks from a magazine loader, places them in fixtures which have been slotted and drilled to grip standard workpiece tangs, then moves them on close centers through the furnace's 24-inch heating length. A transfer mechanism at the end of the furnace picks up each blank and rotates it so as to place the tang where it can be gripped by tongs.

Two horizontal rows of burners (the furnace burns natural gas) heat incandescent-cup surfaces, which in turn beam radiant heat onto the work at high thermal gradient. Because the gas flames do not impinge directly onto the work, scale formation is reduced.

Electric eye control

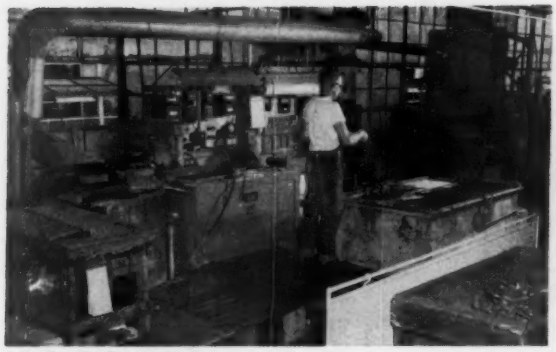
An adjustable electric eye circuit near the Impacter's first die station stops stock feed and Impacter action if the light given off by a glowing blank doesn't come up to a predetermined level. This control prevents die damage by maintaining the blanks in proper plastic condition for good flow in the dies.

The arrangement of the Impacter itself contributes to long die life. Because the blanks are held vertically and the dies come in horizontally, any scale that forms on the blank falls free after each blow.

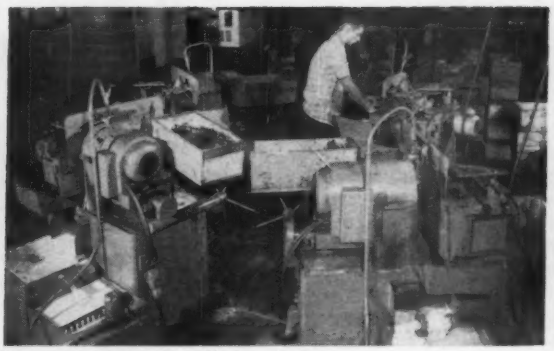
Dies run cooler and have longer life for still another reason: The dies contact the heated work only for an instant during the blow—the work is not laid on a lower die as at a drophammer.

Because of the machine's fast-

with its new Model C Impacter



Salt-bath furnace



Four templet-controlled grinders

striking action, parts can be forged with several successive blows rather than a single hard one. The resulting lower die pressure allows the use of harder, longer-lasting die steels, often incorporated as die inserts, to lower die costs.

Included in the forging machine is a combination of control and power systems. For instance, the impellers that carry the dies are electrically controlled but are powered by a clean air system that allows fast-but-cushioned action.

Blow intensity can be controlled (within reasonable limits) at the control panel, and finer adjustment can be made with valves at the machine. The work handling tongs are powered hydraulically, under electrical control, and can position the work within ±0.010 in. in front of each die station or cavity.

Diemaking equipment

Operating in conjunction with the Impacter is an Elox HRP 102 electric-discharge machine, controlled by an NPS 60 power supply and equipped with a hydraulic servo. This unit accurately duplicates new or old master dies, and in some cases makes new die inserts from old full-size die masters that have been used in production of standard cutlery items.

Diemaking starts with a master die, which is preheated on a hot plate and then placed in a Dake hydraulic press with a retainer. A mixture of 50/50 tin and zinc is poured over the die face, and up to 50 tons press force is exerted down on the assembly as the metal cools. Pressure is maintained until the metal solidifies, to make sure that the metal penetrates fully into all die details.

The cooled form becomes an EDM electrode which is sunk into a die-steel block on the Elox machine. Just after the electrode is cooled, it is coined by pressure in the master die to overcome warp and shrinkage.

The master die itself acts as a holding fixture as the back and sides of the electrode are machined.

Tin squeezes out

The metal alloy (which has a 50% tin content to keep the melting point low and minimize heat damage to the master die) loses much of its tin, which is squeezed out in the press as the alloy cools, leaving the working face of the electrode approximately 80% zinc.

Electrical discharge machining may require from three to six such electrodes, depending on the depth of the die cavity and the speed of diemaking. Roughing cuts are made at 18,000 cps with approximately 60 volts and 20-30 amps; finishing cuts at 130,000 cps with around 30 volts and 3 amps for average die contours.

One important preliminary extra operation requires drilling of several small holes (with diameters from 0.064 to 0.040 in.) through the electrode. In this way, the dielectric fluid which is fed through the machine spindle flushes metal particles from the working gap. These holes, located at critical contour changes, help produce sharp contours in the die face.

Average roughing speed is 0.3 cu in. per hour per electrode at 20 amps on a split machine. A seven-hour diemaking job takes about 1-½ hours for roughing, and 5½ hours for finishing. On a die contour 0.175 in. deep, the roughing cut would take metal out to a depth of 0.155 in., leaving the remaining 0.020 in. for the finishing operation.

The EDM process can be applied (and one day will be) to making trim dies for punchpresses that remove forging flash. EDM will do the job of die hubbing ("typing"), wherein a master is forced straight down into a heated die block to reproduce the master shape (in reverse, however).

Compared to doing the job with EDM, hubbing is slow and costly, and requires annealing and rehardening of the die block, whereas EDM works well on hardened steel. Because EDM requires no heat treating and consequent distortion, it is more accurate.

Some touchup is required, however, on EDM-produced dies to remove bumps made by the wash of dielectric oil as it flows from holes drilled through the electrode. Even so, EDM is faster than hubbing.

Finishing operations

A new Ajax isothermal salt-bath furnace quenches the forgings, removing stresses and producing the necessary edge hardness for scissors and shears.

Some standard scissor blades can now be ground on special grinders, four of them in all. Two grind the left and right edges, and two grind the left and right cutting faces.

Templet controls are set up to allow for edge bow and twist (which ensure that the scissors cut equally well all along the blade edges). These templets can be changed quickly, and setup is easy if a new run of parts of different length and contour is required.

Clauss's newly installed tumbling and vibrating equipment is an adaptation of standard barrel-finishing equipment—set up with special solutions and tumbling media for forged steel parts. •

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Reflection speeds inspection 20X

By John H Peterson
Aircraft Accessory Turbine Dept
General Electric Co
Lynn, Mass

It takes just one-twentieth as long to inspect 213 dimensions on a jet engine fuel control casing by reflection inspection on an optical comparator as it did by conventional layout methods.

The job, a tough one, involves checking 87 hole locations, along with 16 milled, 12 angular and 11 pitch circle dimensions, and casting contours. With reflection inspection, time has been cut from 40 to 2 hours.

We tackled the job at GE-Lynn on the theory that if we could magnify each face of the machined casing, and could measure off these dimensions by a scaled chart, the problem would be greatly simplified.

Initially we investigated photography, but were told that shrinking of photographic materials would destroy the measurement value. So we went to the comparator people.

Special optics

Engineers at Jones & Lamson's Comparator Division soon came up with the solution, an optical system incorporating these features:

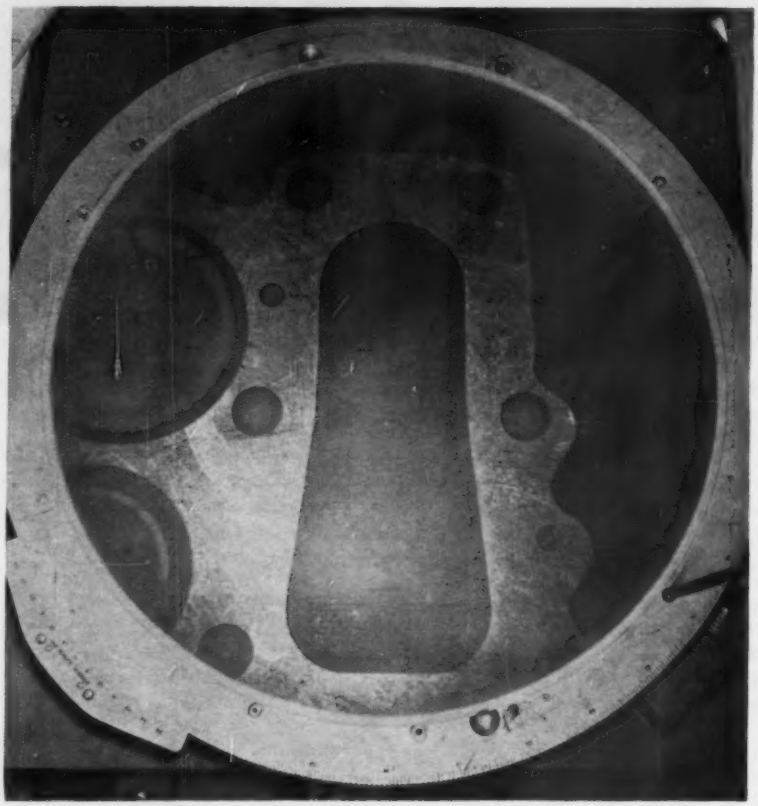
- A 16-inch mirror with 95% reflectivity (contrasted with 60% previously available).
- A 40-60 glass that passes 40% of the light onto the work's surface and returns 60% of it to the system.

The special mirror and the 40-60 glass were used on our Model FC-30 comparator, along with a staging fixture that J & L designed to hold the casing and necessary charts.

These charts were marked with their zoned location on the drawings, and each hole to be checked was identified by letters on both the drawing and the chart. And, because the drawings were so large, a condensed drawing was made in book form—so that all dimensions covered by an individual part could be put on a single page.

All in all, nine 30-inch comparator charts at 10 magnifications were used, plus nine approximately 12-inch-square overlay charts for 10 magnifications covering various sections of each side of the casing.

At first, deep holes could not be checked with normal side reflection attachments, but J & L designed an internal reflection attachment. •



Inspection is 20 times faster when the 10-power amplification on an optical comparator is checked with an overlay chart for each section. Allowable tolerance checks out if center of overlay falls within the scribed square

Complex main fuel control casing for a jet engine has more than 200 bored, reamed, tapped, chamfered and drilled holes. Checking of critical dimensions is simplified by combining reflection inspection with overlays that correspond to each section

Capital spending plans of American industries
(billions of dollars)

INDUSTRY	1960 Actual	1961 Estimated	1962 Planned	1961-1962 % Change	1963 Planned
Machinery	1.10	1.10	1.17	+ 6	1.17
Electrical Machinery	.68	.68	.62	− 9	.63
Autos, Trucks & Parts	.89	.68	.70	+ 3	.74
Transportation Equipment (Aircraft, Ships, R.R. Equipt.)	.42	.39	.42	+ 7	.36
Fabricated Metals & Instruments	.95	.90	1.06	+18	.99
ALL METALWORKING	4.04	3.75	3.97	+ 6	3.89
Iron and Steel	1.60	1.16	1.33	+15	1.21
Nonferrous Metals	.31	.26	.28	+ 7	.35
Chemicals	1.60	1.65	1.62	− 2	1.57
Paper and Pulp	.75	.72	.76	+ 6	.77
Rubber	.23	.22	.24	+11	.26
Stone, Clay and Glass	.62	.49	.53	+ 8	.53
Petroleum & Coal Products	2.64	2.78	3.06	+10	2.94
Food and Beverages	.92	.98	1.04	+ 6	.93
Textiles	.53	.51	.56	+10	.53
Miscellaneous Manufacturing	1.24	1.17	1.20	+ 3	1.21
ALL MANUFACTURING	14.48	13.69	14.59	+ 7	14.19
Mining	.99	.99	.99	0	.94
Railroads	1.03	.63	.64	+ 1	.70
Other Trans, Communications	5.07	5.02	5.03	0	4.84
Elec. and Gas Utilities	5.68	5.75	5.87	+ 2	5.97
Commercial	8.44	8.38	8.72	+ 4	7.85
ALL BUSINESS	35.69	34.46	35.84	+ 4	34.49

Capital Spending: $35.8 billion in 1962

American business plans to invest $35.84 billion for new plant and equipment in 1962, an increase of 4% over the 1961 figure. If these plans are carried out, 1962 will be the second biggest year on record for capital spending. It would be surpassed only by 1957.

• Manufacturing companies as a whole expect to increase their capital outlays about 7% next year. They will spend $14.6 billion in 1962, another $14.2 billion in 1963.

• The metalworking industry plans to put about 6% more money into new plant and equipment in 1962 than it did in 1961. It spent $3.75 billion in 1961, expects to spend $3.97 billion in 1962 and $3.89 billion in 1963.

• Manufacturers on the average were operating at 81% of capacity during September of 1961. This was significantly higher than the 1960 year-end level, but still well below the level the companies prefer to operate at.

• Manufacturers expect sales increase of 7% next year.

• The cost of capital goods is not expected to rise substantially. The anticipated increase averages about 2.6%.

These are the highlights of the new McGraw-Hill Department of Economics fall survey of capital spending plans. These plans, naturally, are preliminary, because many companies do not complete their budget reviews until later in the year.

Previous experience, however, indicates that these preliminary plans will be revised upward when final budgets are set.

Metalworking outlook

The metalworking industry as a whole expects to invest $3.97 billion in new plant and equipment in 1962, an increase of some 6% over 1961. Of the five segments of the industry, only the electrical machinery manufacturers plan to reduce their capital expenditures next year. Even so, if they spend the $620 million planned, it will make 1962 the second highest year on record for capital spending for this industry.

Machinery builders expect to raise their capital outlays from $1.10 billion this year to $1.17 billion in 1962, for an increase of 6%. The greatest percentage increase within this group is expected to come from the manufacturers of office machinery.

The highest percentage increase planned by any part of the metalworking industry, or by any major industry as a whole, is in fabricated metals and instruments. The 18% increase, from $900 million in 1961 to $1.06 billion in 1962, is due largely to continued progress toward automated production—a real boon to the instrument builders.

Even though the auto industry has adequate capacity, it plans to spend 3% more in 1962, a total of $700 million. And transportation equipment manufacturers (mainly aircraft and missiles) expect to boost their outlays from $390 million in 1961 to $420 million in 1962.

Basic materials producers

Steel producers now plan to boost their capital expenditure by 15% next year, even though considerable excess capacity has existed for some time. Such a high level of investment points to continued concern with updating obsolete facilities and installing cost-cutting equipment.

The nonferrous metals industry, which, like the iron and steel industry, cut its spending this year, plans to spend 7% more in 1962.

Non-durable goods producers

Although the durable goods industries as a group plan greater increases in capital spending next year, the non-durable goods industries are not far behind.

Petroleum, for example, plans a boost of 10% in its capital expenditures, bringing the industry's investment in new plant and equipment in 1962 over $3 billion—a level achieved only in 1956-57.

The chemical industry, however, is planning a slight (2%) reduction next year. The operating rate is low in many chemical lines at this time, indicating some spare capacity.

The textile industry plans to spend $560 million next year, an increase

1962 business outlook

INDUSTRY	Capacity—rates of operation: Actual Operating Rate September 1961	Capacity—rates of operation: Actual Operating Rate December 1960	Capacity—rates of operation: Preferred Rate	Sales outlook: Percent Change Expected (Physical Volume) 1961-1962	Price increases: Expected price increases in cost of plant and equipment, '61-62, %
Iron and Steel	74%	50%	98%	7%	2.8%
Nonferrous Metals	79	72	96	9	2.3
Machinery	74	70	92	7	4.5
Electrical Machinery	78	74	93	5	2.3
Autos, Trucks & Parts	79	80	94	8	1.5
Transportation Equipment (Aircraft, Ships, R.R. eq'pt.)	71	71	95	3	3.3
Fabricated Metals and Instruments	79	76	91	7	3.3
Chemicals	79	75	93	7	2.1
Paper and Pulp	90	88	100	6	2.6
Rubber	87	76	96	8	3.2
Stone, Clay and Glass	77	70	90	8	2.0
Petroleum Refining	87	81	97	2	2.4
Food and Beverages	82	81	93	6	1.0
Textiles	87	82	97	5	2.0
Miscellaneous Manufacturing	88	83	94	8	2.6
ALL MANUFACTURING	81	77	94	7	2.6

of 10%. Although a few textile companies reported after the announcement that textile manufacturers could now write-off equipment in twelve to fifteen years instead of twenty-five, it is unlikely that the increased spending reflects these liberalized depreciation regulations. Once this takes hold, textile capital spending may go higher.

Plans for 1963 spending

Manufacturers' plans for 1963 capital spending are already higher than the 1961 level and are only 4% below those planned for 1962. Nonferrous metals, electrical machinery, autos, paper, rubber, and those manufacturers included in miscellaneous manufacturing all expect to spend more in 1963 than in 1962.

Machinery builders plan 1963 expenditures equal to those in 1962 ($1.17 billion), electrical machinery builders will spend $630 million in 1963 compared to $620 million in 1962, and the auto industry will spend $740 million in 1963 for new plant and equipment, an increase of $40 million over 1962.

The transportation equipment industry and the fabricated metals and instrument industry, on the other hand, plan to reduce their capital outlays in 1963 (in relation to 1962 expenditures) by 14% and 7%, respectively.

Capacity, operating rates

Reflecting the improvement in industrial production since the recession low early this year, every industry except the auto industry (which was undergoing model changeover and suffering from strikes) was operating at a higher level of capacity in September 1961 than in December 1960.

Manufacturers as a whole were operating at 81% of capacity, considerably below their preferred operating rate, but substantially higher than the 1960 year-end level. This upturn in utilization of existing capacity may explain, in part, the planned increase in capital investment. For some companies, the higher operating rate may require the use of high-cost facilities which the companies now plan to replace.

The durable goods industries, including the metalworking groups, were all operating at a rate slightly below the average. Transportation equipment registered the lowest rate (71%), followed by steel and nonelectrical machinery (74%).

Sales picture bright

Manufacturers expect next year's sales to be up considerably from those in 1961. On the average they expect sales gains of about 7% in physical volume. Such an optimistic sales picture provides strong support for a higher level of capital spending next year.

The auto, truck, and parts industry anticipates sales increases of 8% in 1962, and car makers who may have lost some business this year because of strikes expect to make up the loss next year.

Other transportation equipment manufacturers, largely aircraft, expect sales will rise only 3% in 1962. With most airlines fully converted to jets, the sales increases in this industry will come mainly from defense work. Sales expectations of all other manufacturing industries, with the exception of the petroleum industry's expected 2% gain, hover around the 7% average.

Equipment costs up slightly

Business expects to pay only about 2.6% more for new plant and equipment in 1962 than it did in 1961. This is an average for all types of equipment and facilities, and the price for any individual item may vary considerably from this average.

A price increase of this magnitude does not suggest that business as a whole expects inflation. Historically, capital goods prices have risen at a faster rate than other prices during inflationary periods. Thus, if these prices are held to within 3% of 1961 levels, it augurs well for the economy as a whole. •

Outlook: More precision machining

Job switch for T&D makers?

The next decade will probably see a decided switchover from tool and diemaking to precision machining and prototype work.

That's the conclusion reached in a report made at the 16th Annual Membership meeting of the National Tool, Die and Precision Machining Association, at Pasadena, Calif, October 24 through 28. The report was made by NTDPMA's Advisory Committee and revised by its Policy and Planning Committee.

Tool and die work is not expected to keep pace with the overall growth of industry and the national economy in general, according to the report, which adds that tooling requirements are actually declining now and this trend is expected to continue.

Reasons for the expected decline: imports of foreign products which contain hidden tooling, standardization of interchangeable parts in the automotive and appliance industries, and growing use of numerically controlled machines.

Even so, the consensus of attending members is that tool and die business should increase by 10 or 15% in 1962 over this year.

The problems

The report foresees that the most serious problems facing the tool and die industry over the next five years (and probably the next 10) are these.

- How to increase volume of work.
- How to make better businessmen and managers of plant owners, who are basically skilled mechanics.
- How to make better foremen and supervisors of men who are also basically skilled mechanics.
- How to recognize the importance of good personnel relations, and make optimum use of employees, since payrolls are a major cost.
- How to establish and maintain a sound financial structure.
- How to perpetuate a closely held or family business.

The outlook

Even now, a growing need for special machines is causing tool and die shops to devote a larger part of their time to building them, less to the making of tools and dies.

Competition within the industry itself is expected to become keener and keener, especially for less-complex jobs, the report states. Actually, new shops are being started all the time—and even established firms must seek better ways to compete and to operate profitably.

Specialization within certain categories of tooling, special machine building, and precision machining has been suggested as a way of maintaining profitable shop operation. Another possibility: development of a product or line of products tailored to the individual firm's facilities.

Among the most pressing problems confronting today's tool and die shops are means of acquiring more working capital and money for new equipment. One reason for this, according to the report, is a general lack of financial management skill on the part of tool and die shop operators. Company management should either acquire this skill, it was suggested, or be willing to retain outside counsel.

The report went on to take up problems of closely held businesses, such as family-owned firms. Planning for any business requires careful coordination and training of future management. Too often, such family businesses ignore this, so that their ideas and concepts may be no longer valid. It was recommended that such firms discuss management matters with estate planning experts, to assure continued operation of the business.

The report also recommended that personnel who help run a business be provided with the authority and responsibility their position requires, and that they should be kept informed of company policies and plans for the future.

In discussing the outlook for 1962, attending members believed that the expected 10 to 15% increase in business this year will stem from increased defense spending, which will sift down to the shops early in 1962. And major tooling programs are expected in the auto industry for the 1963 models (not like the mere facelift changes of '61 and '60). The 1963 models are expected to include major body and transmission changes. In fact, tooling orders are already out for some 1963 transmissions.

Foreign sales problem

Reporting on increasing foreign competition for the U S tool and die industry, Lawrence M. Weitzel, president of Los Angeles Mechanical Specialties Co, said that American shops must improve the quality of their products if they want to sell them overseas.

The metalworking industry in France is as sophisticated and as advanced as ours, he said. Describing a trade mission to France last fall, Weitzel quoted a report by French importers of U S metalworking products:

"United States products are no longer as good as they were in the past. Although the average quality is still first class, they lack finishing touches. More attention should be given to import requirements."

It was also suggested that the U S make more liberal credit allowances if it is to boost overseas sales. American manufacturers are generally far less liberal than their European competition, who in some cases sell on a "No down payment" basis with five years to pay.

France's economy, Weitzel said, is now in high gear. Only 30,000 of the total population is unemployed, and there are jobs available for many more than that. Many manufacturers, he added, are looking for U S products to make under license, many family-owned businesses want to expand, and France has idle facilities available for work.

Weitzel said that manufacturing pools (similar to those serving the U S defense industry) are proving very effective in France. These pools act as an association of manufacturers in which member firms combine their facilities and assets to broaden their manufacturing ability.

Recent business conditions

Latest NTDPMA report on business conditions in the industry shows that sales invoiced for August showed a decline of 4% from the previous month, and that sales were 24% below August of 1960.

But backlogs have been improving, the Association reports. The August, 1961, backlog was 12% higher than that for July, and was only 4% below the backlog of August, 1960—bearing out predictions by industry experts that business is on the upswing and will show a fairly sharp rise in the first and second quarters of 1962. •

55 COST-CUTTING IDEAS

These last of 55 money savers—compiled by Harold Sizer, director of design, Brown & Sharpe, Providence, RI—complete the suggestions on welding, and end the series with ideas for metal fabricators. For reprint information, see next page

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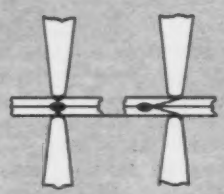
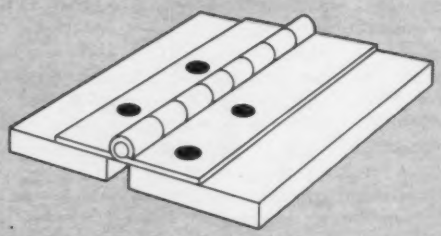
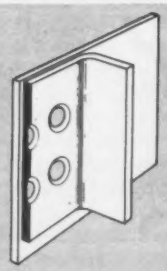


SPOT WELDING is cheap for materials under 1/4 in. However, welds too close cause shunts



USE SPOT WELDING where welds can be spaced far enough apart to avoid shunting



PROJECTION WELDING allows closer spacing, better strength, and costs less than spotting

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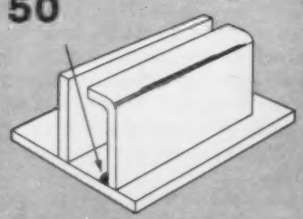

DESIGN FOR ACCESSIBILITY of welds; Avoid blind corners, deep pockets, recesses

METAL FABRICATION

In designing parts to be formed, cut, or drilled, the designer can save money by paying careful attention to the various methods available. This last section of ideas gives some cost comparisons, and a few considerations, for metal fabrication

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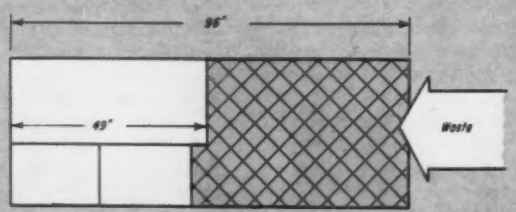

USE STANDARD SIZE SHEETS to minimize amount of waste. Sometimes, by changing dimensions just slightly, extra parts can be made from 'waste'

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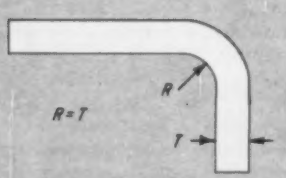
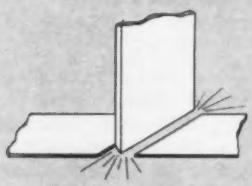
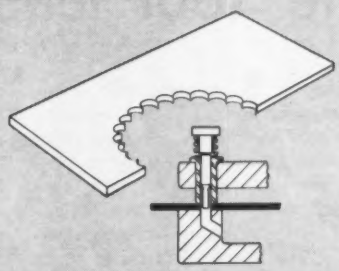


BEND RADII should be about wall thickness. This gives less distortion, max stiffness

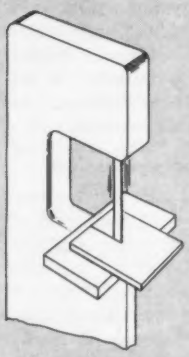
53 DESIGN FOR LOW-COST SHAPE CUTTING. Consider requirements, and evaluate different methods:



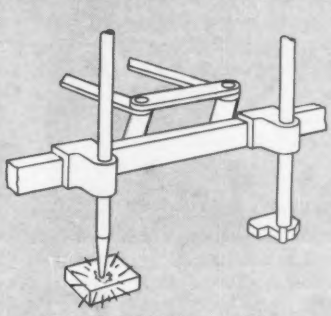
SHEARING, least expensive, cuts straight lines — .0148 ¢/ft



NIBBLING gives irregular shapes accurate to 1/64 in. — .032 ¢/ft



SAWING gets into corners nibbler misses, to ±0.010 in. — .12 ¢/ft.



FLAME CUTTING is good for reducing large sections — .205 ¢/ft

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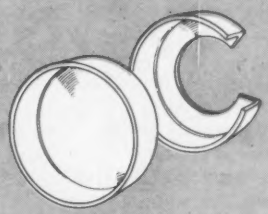
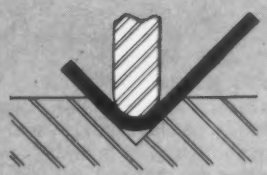
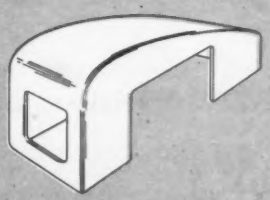
FORMING METHODS vary in cost, so check for least expensive:



STAMPINGS are cheap, and can be gas cut after stamping. Check the dies available



MACHINE FORMING is 2nd choice, but parts may not be alike. Skill and time are required



HAND FORMING should be avoided. Compound curvatures require costly hand work

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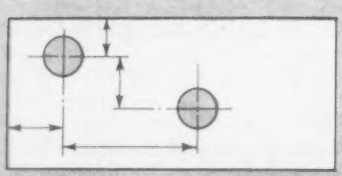
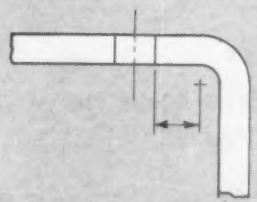
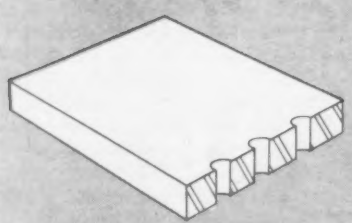


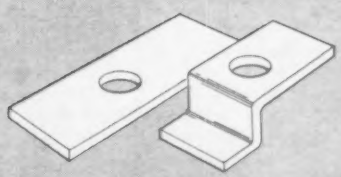
HOLES CAN BE HELD within 0.010 in.; investigate when closer tolerances are required



AVOID HOLES near line of bend to avoid deformation. Figure 1½ thickness away from bend



AVOID PUNCH FAILURES by specifying holes of a lesser diameter than thickness of material



HOLES SHOULD BE PIERCED before forming workpiece to avoid using special fixtures

REPRINTS

of this four-part series are available from the Reader Service Dept. American Machinist/ Metalworking Manufacturing, 330 W 42 St. New York 36, NY. Single copies of this series are 35¢. (Price reduced for quantities over 100.)

AGMA meeting highlights

10-year machine tool lease plan

A 10-year lease plan for machine tools was proposed at the fall meeting of the American Gear Manufacturers Assn in Chicago, Oct 30 to Nov 1.

In offering the plan, Robert Sheridan, president of Nationwide Leasing, emphasized that the long-term leases would provide minimum rates together with the opportunity to replace obsolete equipment on a long-range plan.

The 10-year plan requires no security deposit and calls for level payments over the term of the lease, but is limited to companies with a tangible net worth of $1 million, a five-year record of profitable operation, and minimum requirements of $25,000 worth of equipment. While rates will vary with conditions, the examples Sheridan gave in his talk were based on 7% simple interest. Nationwide is now extending seven-year leases to companies not large enough to qualify for the 10-year term.

Standard practice manuals

Substantial progress is being made in the manual of standard practice for machine tool gearing that is being prepared by an AGMA committee headed by J M Claflin of Warner & Swasey. Drafts have been prepared for the sections on tooth proportion, materials and heat treatment, gear blanks, mounting, lubrication, and tolerance requirements.

Standard definitions

Similar progress is being made on others in the series of standard practice manuals that AGMA is working on. As part of the inspection manual, an attempt is being made to agree on standard definitions for all the terms used in gear inspection.

There is strong sentiment for changing the designation "total indicator reading" to "full indicator reading," to conform with recent standardization practice of the Society of Automotive Engineers.

Modified pinions

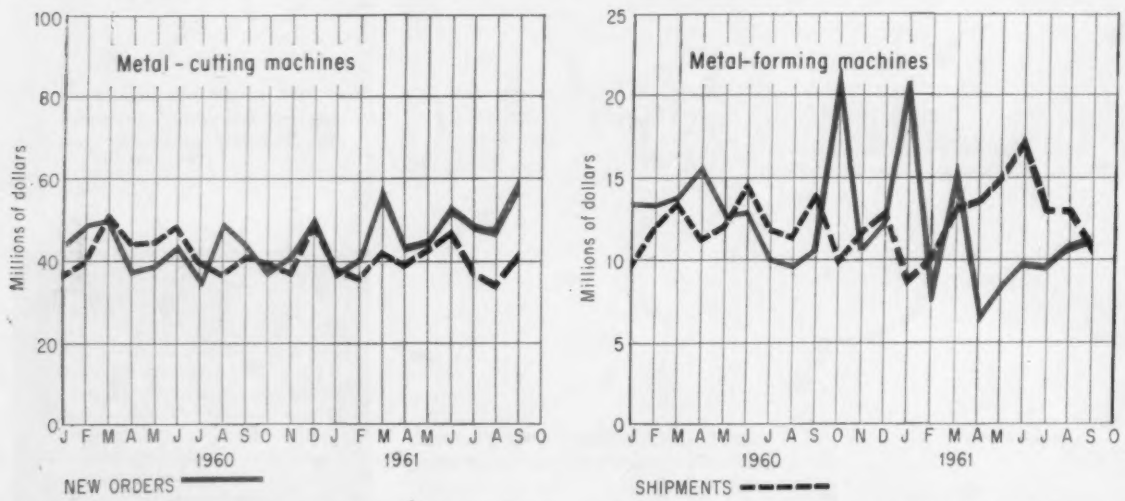
A method of avoiding ever-finer pitches in meeting the needs of miniature gears was proposed by Richard L Thoen of General Mills. Involute spur pinions with as few as four teeth can be generated with conventional hobs, resulting in higher ratios per mesh, coarser pitches, and fewer of the manufacturing and inspection problems inherent in extremely fine pitches, Thoen said. He described a tooth modification system based upon gear tooth contact ratio.

In this system, pinions with 21 teeth and fewer are enlarged to yield the maximum contact ratio that can be obtained with the pinion tooth thickness tolerance and hob addendum dimensions.

Machine tool symposium

First of a series of symposiums on available equipment to produce gears was a major feature of the meeting. Covering equipment for hobbing, shaping, cold forming, bevels and broaching, the symposium included reports from Barber-Colman, Fellows Gear Shaper, Gleason Works, Gould & Eberhardt Div of Norton, Michigan Tool, and National Broach & Machine. Copies of the complete review from this first symposium are available from AGMA, 1 Thomas Circle, NW, Washington, DC. •

NMTBA Index of machine tool new orders and shipments



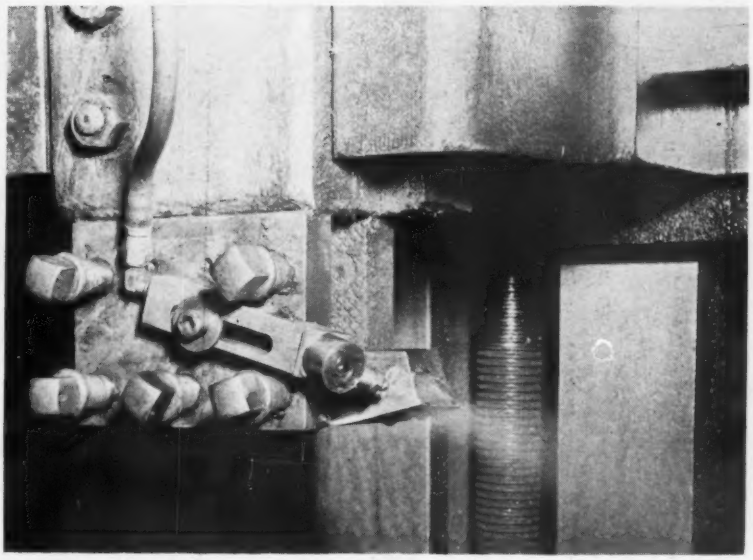
Net new orders for metal-cutting machine tools climbed to $56,750,000 in September, establishing a new 1961 high, according to preliminary figures from the NMTBA. This represents a gain of $11,950,000 over August orders. Shipments of metal-cutting machines rose from $34,000,000 in August to $41,650,000 in September. Orders for metal-forming machines rose from $10,100,000 in August to $10,550,000 in September. Shipments dropped from $12,950,000 to $10,450,000.

Rigid nozzle directs mist cooling

By Jesse G Sdano, tool supervisor
Tools & Facilities Engineering
West Allis Works
Allis-Chalmers Mfg Co
West Allis, Wis

A new type of nozzle has solved one of the most serious problems in mist cooling of metal-cutting operations at Allis-Chalmers' West Allis (Wis) Works.

Until now, chips moving away from the cutting tools have hit and deflected flexible copper and synthetic rubber nozzle tubes, causing the coolant mist to miss the cutting area. So serious has this problem been at times that the machine operator has had to keep an eye on the flexible tubes almost continuously.



Heavy-duty adjustable nozzles developed for mist cooling systems on vertical boring mills and other large machines are bolted securely in position and eliminate deflection by moving chips almost entirely

Chips can't deflect it

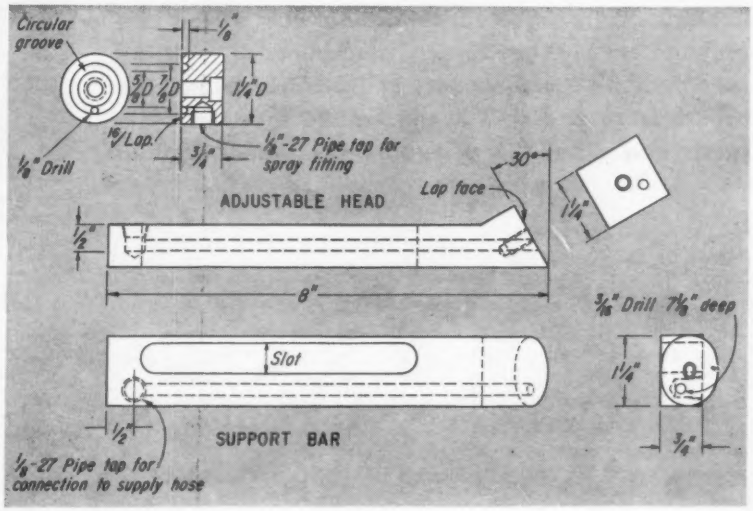
Allis-Chalmers engineers have overcome this difficulty by substituting a nozzle that can be locked rigidly in place. The nozzle assembly consists of a slotted steel bar, which can be tightly bolted to the tool block on the machine, and which carries an adjustably positioned nozzle head that moving chips can seldom move out of position.

A 3/16-in.-diameter mist coolant passage is drilled longitudinally through the nozzle support bar from the nozzle-head mounting face to a ⅛-in. pipe connection near the other end. This inlet connection can be drilled and tapped in the end or top face of the bar, whichever is most convenient.

Outer end of the support bar is upset and beveled at 30 degrees to form either a 1¼-in. square or round face that is lapped to a fine finish (16 microinches or smoother) for a leakproof joint with the grooved bottom face of the 1¼-in.-OD adjustable nozzle head.

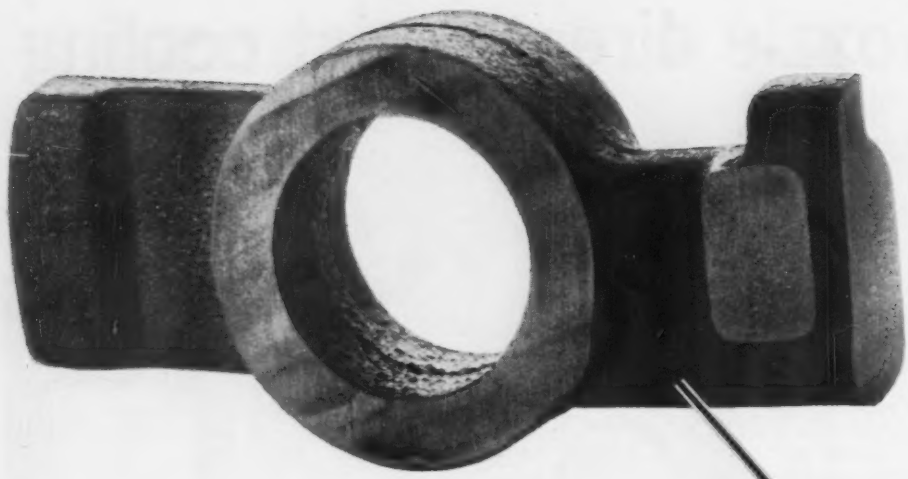
The nozzle head is grooved and drilled to provide a continuous connection between the mist coolant passage in the support bar and a ⅛-in. pipe-tapped opening in the periphery of the head. Into this opening is assembled the mist nozzle, which directs aerated coolant to the cutting area, usually from under the heel of the tool.

Nozzles are made from Alemite or Zerk pressure lubrication fittings, which are modified by removing closure balls and retaining springs. Straight, 45-degree and 90-degree fittings are employed, depending upon the angle at which the mist coolant is to be directed toward the cutting tool.



Typical adjustable nozzle support assembly developed for large machines equipped with mist cooling systems consists of a slotted support bar, drilled to pass aerated coolant from supply hose to adjustable swivel head bolted to beveled outer end. Adjustable head is grooved and drilled to pass the coolant to a modified lubrication fitting assembled to pipe-tapped hole in its periphery. Nine different types and sizes of these mist coolant adapters have been developed

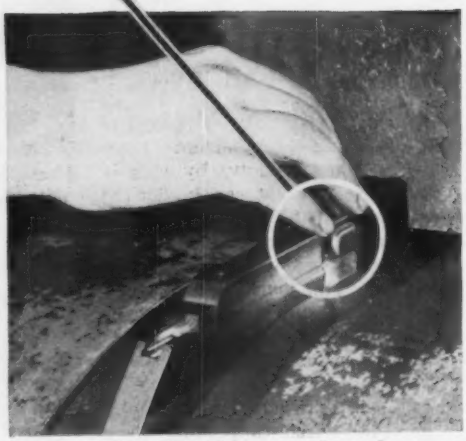
Nine different sizes and types of nozzle support bars have been developed for mounting on various vertical boring mills and turret lathes, and other machine tools in the West Allis Works. For the larger machines (like a 30-foot boring mill for machining water turbine castings), extra-large adjustable nozzle assemblies deliver the coolant mist close to the cutting edges of the single-point tools. •



Tunnel broaching small parts

Continuous throughfeed broaching has solved the problem of high-production machining of a tricky automatic transmission part at Ford-Sharonville. The broach is so fast that it can handle four times the present output of 175 governor-valve bodies an hour

By Walter Sutton, applications engineer
Foote-Burt Co, Cleveland



Continuous-chain broach can machine three precision surfaces on this governor-valve body at rates as high as 680 an hour. All operator need do is drop parts in fixtures as they pass

Machining three surfaces of a small governor-valve body looks easy enough at first glance. It isn't—especially when the job has to be done at a high rate of production (one goes into every Ford automatic transmission turned out at Ford's Sharonville, Ohio, plant).

Looking for the quickest and most economical way to do the job, Sharonville planners came up with continuous throughfeed broaching.

For such an operation, Ford needed a machine that would meet these requirements: (1) have enough excess capacity to handle emergency production demands, (2) have easy-to-change tooling, plus the ability to convert to broaching of other parts, and (3) be simple enough for an unskilled worker to operate.

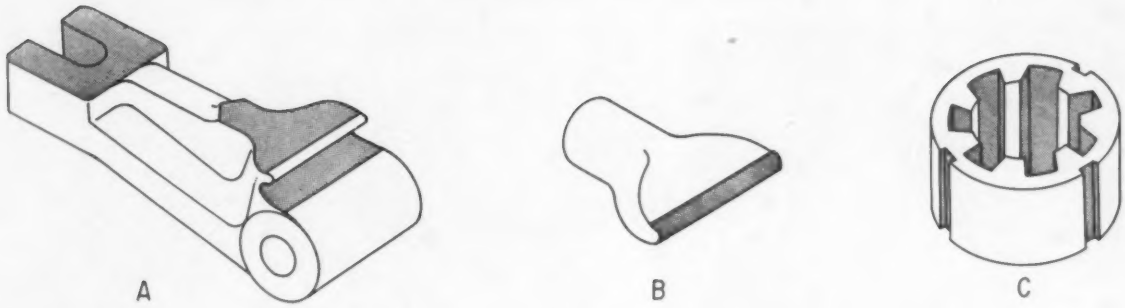
The governor valve is a deceptively simple part, made of SAE 111 gray cast iron. It locates on the output shaft of all Ford automatic transmissions, rotating with the shaft. In the transmission, the governor is an integral part of the hydraulic control linkage.

But machining is anything but simple. Bosses on two parallel sides of the casting have to be machined within ±0.0025 in. The end face must be flat to within 0.0005 in., burr-free, with sharp edges, and a 50 micro-in. finish. And a rectangular pad must be machined on one side to a location tolerance of within ±0.0025 in.

Meeting requirements

Ford's choice: a Footburt No. 5 horizontal broaching machine, which met all the requirements specified above:

- Normal output of the machine is 680 parts an hour at 85% efficiency. At the moment, Ford needs only 2800 governor-valve bodies a day (175 an hour). Thus the unit's capacity, almost four times the current demand, is certainly adequate for emergency requests that the plant may receive.
- Changing the tooling, or converting to broaching of other parts, is very simple. The broach has a removable tunnel head with adjustable tapered gibs that position the cutters accurately. Tool changeover is simply a matter of lifting off the head and replacing it with an alternate head that contains freshly sharpened tools. And setups are quick, because the tapered gibs are readily adjustable.
- Operation of the machine does not require a skilled worker. The operator merely drops the workpiece



Other broaching operations at Sharonville turn out these three parts. See text for description of how each is broached

into a fixture on the endless chain (see picture). The machine itself positions and clamps the part for the broaching operation.

How it works

On the machine, an endless chain containing six fixtures moves continuously from the operator's end through the broach tunnel head to the discharge end. Like a conveyor belt, the chain and its fixtures continue around a drive pulley, returning to the operator's station. A 10-hp motor powers the driving sprocket, through a worm drive and helical gear reducer.

As a fixture passes him, the operator drops a part into it. Location and clamping are automatic: An end stop pin at the fixture's bottom establishes the part's position, and lateral walls center the valve bodies in the fixture. As the chain advances a cam-activated lever automatically closes two V's around the rough-bore OD, clamping the part rigidly so that it can resist the heavy, broaching forces.

As the fixture begins to enter the broach tunnel, it locates on hardened-steel precision guides. At the tunnel mouth, a swinging gate detects any improperly clamped part, stopping the machine instantly. Thus there is no chance for damage to the broach teeth, and the operator also is protected, because his hand cannot enter the tunnel.

During the cutting process, parts move through the cutting head and discharge automatically into baskets, fully broached. The machine that Ford uses can remove nearly seven cubic inches of metal a minute. A flood of mineral-seal oil serves both as coolant for the part and lubricant for the broach chain.

Construction of head

Broach length within the tunnel head is 40 inches. Actually, the tunnel head holds twelve broach sections: Four sections on each side broach the bosses and pad, and four at the top broach the end face. Each four-section set consists of a roughing broach, two intermediate stages, and a finishing broach.

Every 20,000 parts, the broaches have to be resharpened. Removal of the sets is not complicated: A crane lifts off the complete broach tunnel head and replaces it with a spare, which is complete with sharp broach sections.

As part of Ford's policy, the toolroom maintains eight sets of broaches: one in the machine, one in a spare holder, a third in process of sharpening, and five more on the shelf to meet emergency demands. Although Ford allots 2½ hours for a changeover, it can be done in a matter of minutes, thanks to the modular construction.

The new set of broaches has to be adjusted, because about 0.002 in. are removed from the broach teeth during sharpening. To correct for this condition, the operator runs a sample part, gages it, and then adjusts tapered gibs on which the broach sections mount. This adjustment is a big improvement over earlier types of continuous broaching machines, which require subholders and shims for the job of positioning cutters. With shims, the broach teeth must be pre-set before the tunnel goes into place. Here, if sample parts are not within tolerances, the machine must be shut down and the tunnel must be removed to adjust the broaches. On the new machine that Ford uses, each set of four broaches mounts on an adjustable gib that locates directly against the side of the tunnel head.

Other broaching work

At Sharonville, there are eight other broaching operations. Three of the most interesting appear in the sketches above:

A — Another continuous broach generates levers in much the same manner as the governor body—except that they pass through the machine twice. The operator loads the 1045 forgings vertically into a fixture which passes through the tunnel, broaching two flats and the tooth form. Then the levers are discharged to a conveyor and returned to the operator, who now places each part laterally. The second operation broaches the slot. Production rate is 180 parts an hour; broach life is about 12,000 levers.

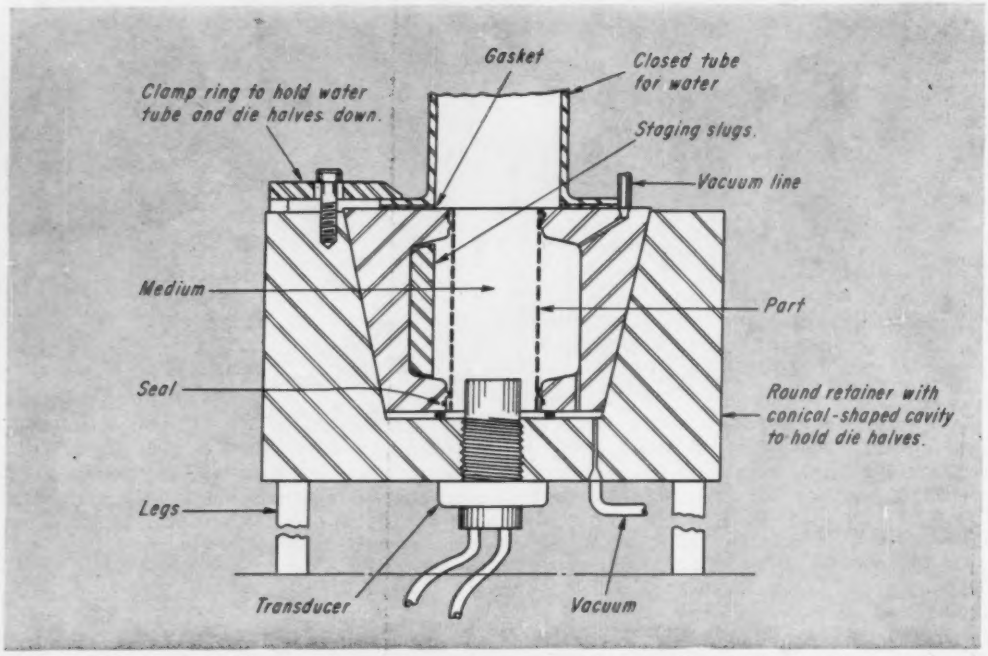
B — A matching tooth form is machined on a small vertical broach nearby the lever broach.

C—An unusually severe three-step operation generates this cam form on a clutch outer race. On the first stroke of the vertical broach, internal teeth are rough-formed in an 8620-steel ring blank. After resetting the ram, the cam-form inner teeth are broached. Then a special fixture indexes the part to a third position, where a push-through pot broach generates three radial slots. The broaches remove over 2 cu in. of metal from each part, producing one part every 15 seconds. Machine stroke is 56 in., at 25 fpm.

Other vertical broaches produce splined cores—two at a time—in dual-ram push broaches. Parts for two different transmission models are fed from automatic loaders, then discharged into conveyors.

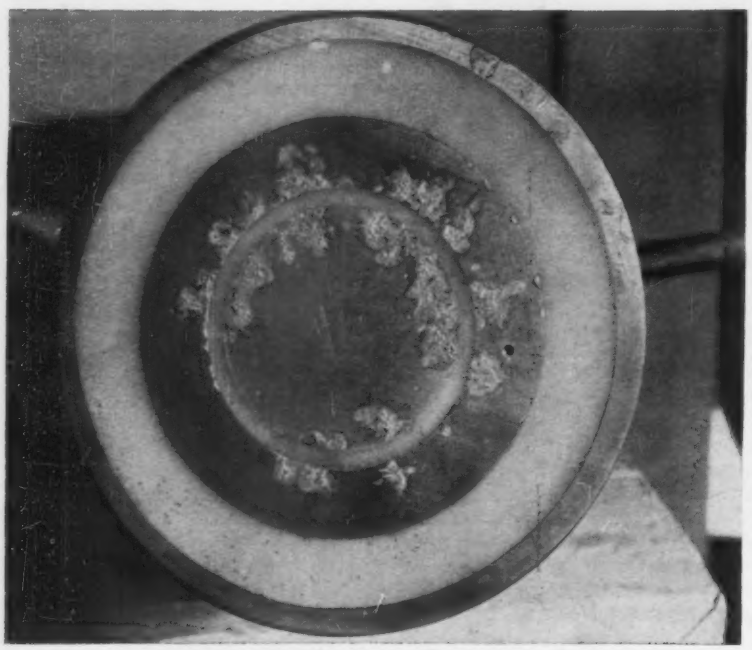
Three other parts are broached at Sharonville:

- Throttle-control levers, which control oil portage to the transmission, have two tiny flats broached right behind the threaded end.
- External pot broaching generates a stator end plate.
- A similar pot-broaching operation generates all the splines on the circumference of a part. •



Spark discharge forming with a transducer: Current from power pack passes through the transducer, producing a shock wave in the water-filled die area and forcing the metal blank or part against the contours of a closed die. Staging slugs are placed in the die for the first shot, are then removed and a second shot is made, deepening the contour. The die illustrated has staging slugs for making tubing to a specific wall thickness

Spark forming goes to work



About 100 firings were made with this low energy transducer before the face began to show appreciable pitting and erosion. The dielectric material in which the electrodes are potted, the geometric pattern of the electrodes and their material are as important to transducer efficiency as surface condition

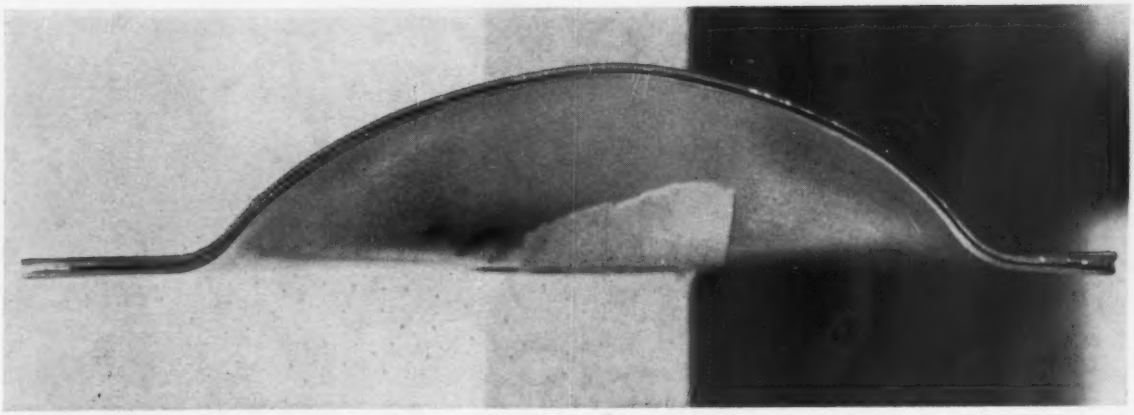
Here are two electrical spark discharge forming processes that have successfully produced hundreds of parts from difficult - to - form materials, bringing this relatively new high-energy-rate forming technique out of the lab and onto the production line

By Gil C Cadwell
Senior manufacturing research engineer
Rohr Aircraft Corp Chula Vista, Calif

Hundreds of aircraft and missile parts have already been turned out on a pair of electrical discharge forming machines at Rohr Aircraft, Chula Vista, Calif.

So versatile are these machines that both of them can form parts either by:

• Using a spark gap from a transducer to produce a shock wave in water, oil or some other liquid medium, forcing a metal blank to assume



Exact duplication of a free formed shape, achieved with electrical discharge, is illustrated by two 4-in.-dia aluminum blanks cut in half and placed together. Precise control over energy levels not only provides this high degree of uniform quality but also prevents overloading of dies. Uniformity such as this can be attained by either EDF method

the exact shape of a closed die. • Vaporizing a wire which is connected across a spark gap, creating a pressure wave that forces a blank to assume the shape of a closed die —a method also performed under water or other liquid medium to minimize explosive effects.

While neither of these methods is exactly new (they were first reported in *AM/MM* Oct 19 '59, p123), the fact that Rohr is spark forming parts on a production basis, and has been for some time, *is* news.

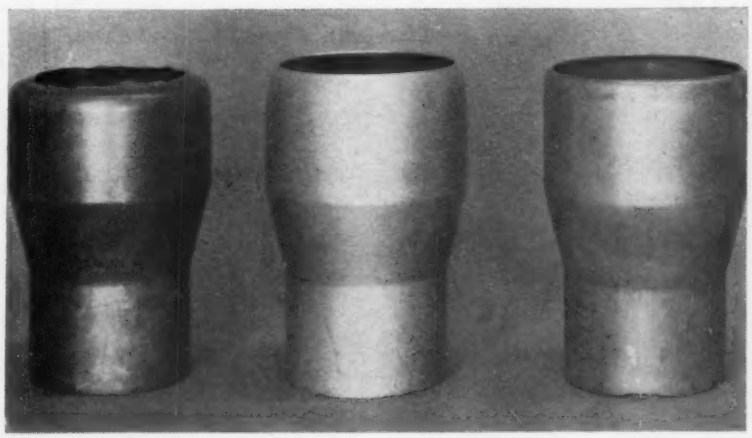
Both methods employ the same electrical discharge power pack, are entirely compatible with other shop operations, and require only the normal safety precautions associated with high-voltage equipment.

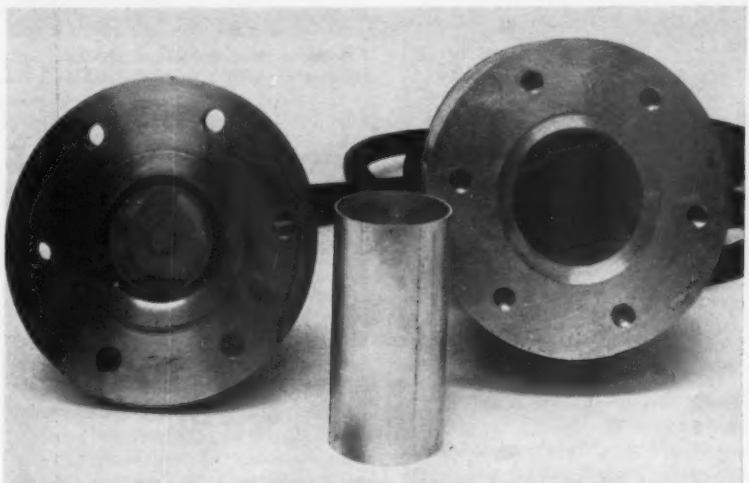
The first (and oldest) of Rohr's two machines is a 6-kv prototype with a 4300 watt-sec output; the second has a capacity of 14.4 kv and 11,500 watt-sec output, and is of modular construction—so that its capacity can be expanded to 46,000 watt-sec output if the need arises.

Transducer method

Here, a spark jumps across electrodes submerged in water—successively heating and vaporizing a thin channel of water and converting it into a plasma. The current pulse which causes the spark to jump has a duration of only microseconds. Because of this, the material in the spark channel heats and expands so fast that a shock wave is transmitted through the medium.

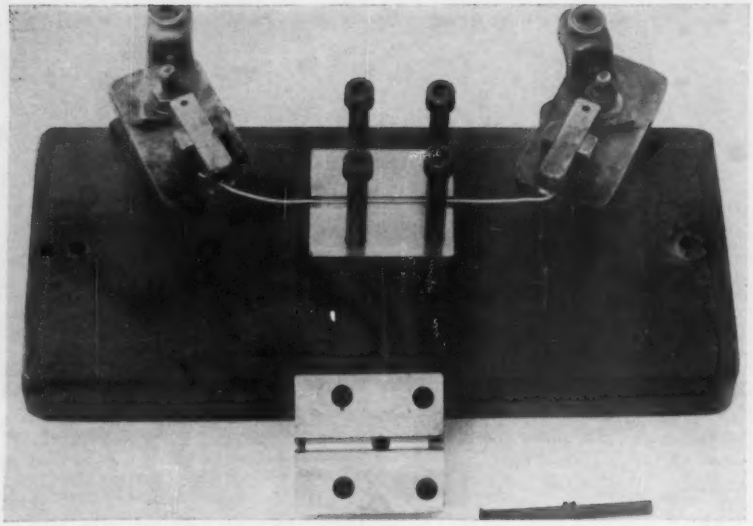
Forces developed by the sudden compression of liquid around the discharge channel radiate from the line of action of the spark, moving

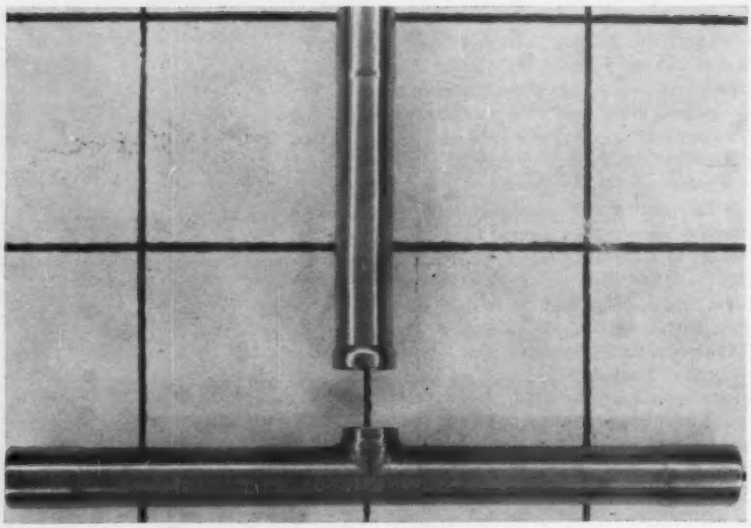




Eight separate operations were eliminated by using electrical discharge forming instead of conventional means in expanding this 321 stainless steel part (top, right) to 3¼ in., with a tube thinning of 0.0015 in. The tube was loaded into an aluminum die, formed, and unloaded in 3 minutes. The same part, made from copper tubing, is at far left and one made from aluminum in the center

Spark forming goes to work





Exploding wire method of electrical spark discharge forming makes use of a wire running through a part enclosed in a die. This piece of 0.045-in.-dia titanium wire is connected between electrodes in position to form a 0.016-in.-dia stainless steel tube into a tee with sized ends, bottom. Upper section is later welded to formed tee

Two 0.060-in.-dia titanium wires 12 in. long were used to form this 321 stainless steel part. Original tubing (2½-in. OD with a wall thickness of 0.035 in.) was expanded to 3.180-in. dia. Job required 9000 watt-sec of energy. Forming is so precise that minute tool marks in the die are transferred to the part as indicated by the unpolished right end

the metal part (which is located near the spark gap) to conform to the shape of the die.

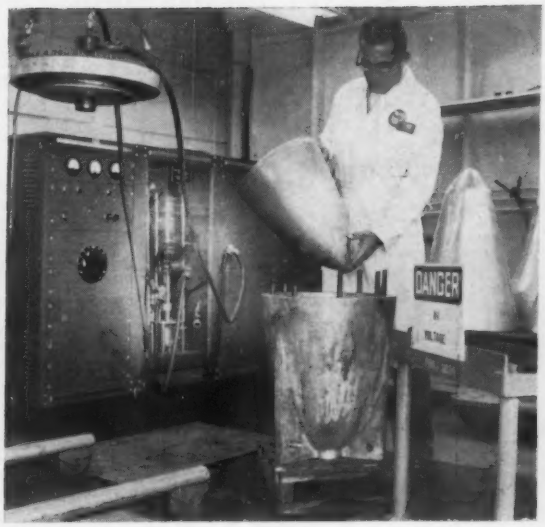
Rohr's use of a transducer for this work takes it out of the area of simple spark gap forming, because it greatly increases control of the discharge force. Contributing to the efficient operation of the transducer are such factors as electrode material, dielectric potting material; and geometric pattern, surface, shape, and condition of the electrodes.

A transducer can produce several hundred parts before its surface needs to be dressed so as to remove pits and other defects caused by discharge of energy. Reason for the long time between dressings is simply this: The spark has a high temperature, but because of its short duration little damage is done to the electrode surface. Rohr estimates that electric power cost for 25 firings is 1¢.

Exploding wire method

With this technique, a small-diameter filament (initiating wire) is connected across the electrodes in the spark gap. The wire is vaporized and converted to a plasma by a current pulse, increasing the volume of the wire by as much as 25,000 times

After forming, one of a run of 133 stainless steel parts is removed from the die. Production rate for these parts is one every two minutes and seven operations are eliminated by using spark discharge forming instead of conventional methods



A missile nose cone is removed from an aluminum die after forming. Rolled and welded cone with nose cap (right) is the preform required to form this part. Suspended on the left is the die cap with transducer protruding

and creating a pressure wave. The techniques are otherwise identical.

Advantages of the exploding wire method are these: discharge path is easier to control, shock wave can be shaped by bending the wire to conform to the die cavity, longer gaps can be used for a given amount of condenser energy, and the process can be used in areas too small for a transducer. Not only that, the exploding wire method does better forming in instances where a long arc (rather than a point source shock wave) is required.

But this method does have a couple of disadvantages: It costs a little more (because of the cost of the wire), and new wire must be restrung after each shot.

Wire material, gage size length and energy level are all critical. Tungsten wire produces the greatest force, followed in order by tantalum, columbium, molybdenum, titanium, nickel and aluminum. Wires up to 0.080 in. dia and 14 in. long have been used for this work.

As to tooling: Aluminum dies, which require a minimum of machining, have been found to be practical with both methods, and plastic dies have been used experimentally with good results.

Because control over energy levels is excellent, it is possible to establish the precise required level without causing excessive stress loads on the dies. For example, hundreds of hard steel parts have been formed in a single aluminum die which to date has shown no sign of wear or erosion. As a result, low tool cost can be listed among the advantages of both methods. •

Salvaging $428,235 in chips in a year

Up to 250 tons per month of aluminum chips and shavings are being salvaged from 28 milling machines at Boeing-Wichita, where 80,000 gallons of liquid is circulated through 2250 feet of underground flumes to deliver chips to an adjacent heat-treating facility.

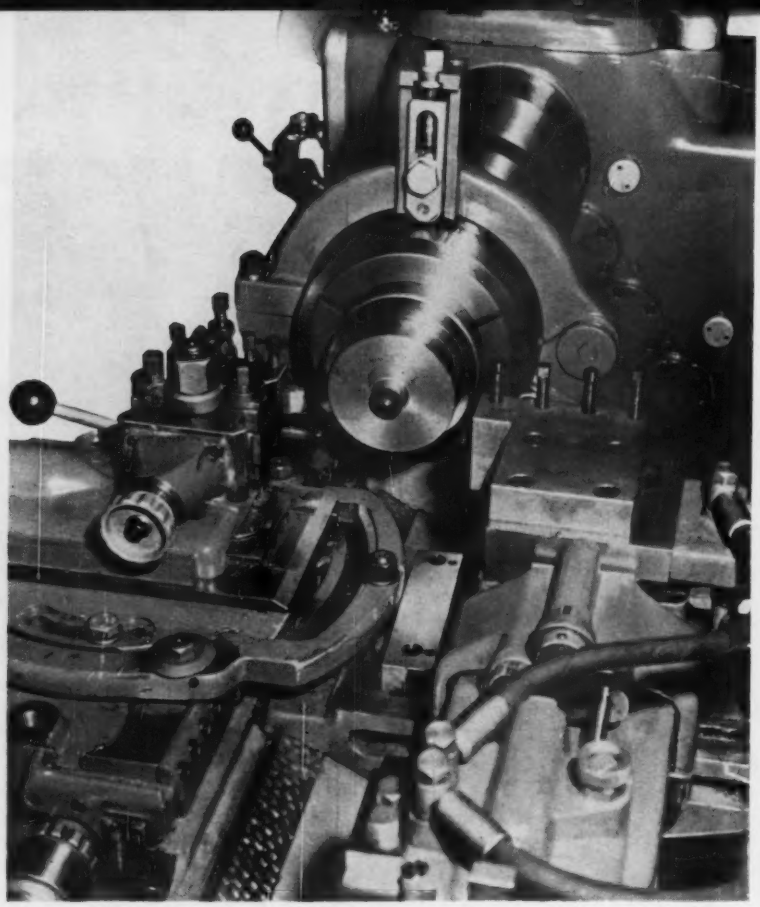
Chips from 16 of the mills reach the flumes through tunnel entrances level with the floor. Chips from six other mills not directly connected to the system are carted to large funnels located over the 3 x 5-ft tunnels. Vacuum suction equipment near the cutters of most of the mills picks up the chips and blows them through slots in iron grates into the tunnels. Chips from other mills are rolled on augers to collection points.

A gravity-drained network of sluiceways carries the chips to a central channel, and then to the treatment facility, where the chips are strained out and prepared for sale. The sluice fluid (the same as that applied to cutters at the milling machines) is one part soluble oil and 30 parts water.

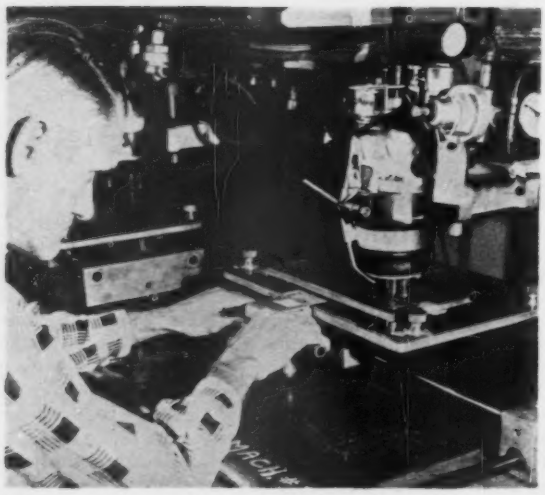
Four pumps, each with 6000-gpm capacity, keep the coolant in constant circulation. A series of six cyclone centrifuges removes all solid particles larger than 0.004 in.

The main coolant flow, carrying the chips, travels at a rate of about 12,000 gpm, moving into a revolving drum with walls of stainless steel screen. Drum baffles drop the chips onto a conveyor belt moving through the center. The belt takes them to bucket elevators, which in turn convey the chips to crushers and onto a high-speed centrifuge dryer. The dry chips are then augered to another bucket elevator that takes them to storage bins. The facility is operated by one man. •

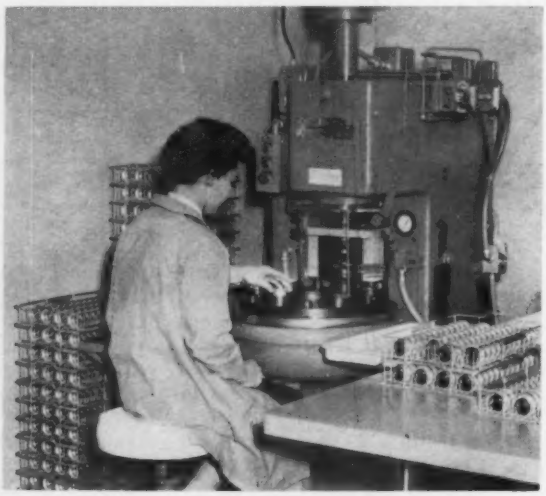
SHOP SHOTS



Cap end of 105-mm shell blank . . .
is turned and threaded in 1.75 minutes on this Man-Au-Cycle single-point threading lathe. Air-operated draw-back collet chuck, supported at outer end by a steady rest, holds blank against depth stop on collet. Hydraulic facing attachment (at right) carries three tools in a special block for turning and chamfering. Threads are cut in a completely automatic cycle with a carbide tool of Acme thread form



Templet-guided drillhead . . .
drills precisely located holes in epoxy-resin glass fiber printed-circuit cards for Philco Corp's "2000" electronic data processing system. "Electrolized" (hard-surfaced) drills made by Morse Twist Drill & Machine Co provide long tool life despite highly abrasive nature of epoxy-resin glass fiber



Telephone receiver components . . .
are spun together on an 8-ton Denison Multipress equipped with a 6-station rotary indexing table. This final assembly step, like several prior operations, takes place in an air-conditioned, dehumidified and pressurized "clean room" at the Automatic Electric Company plant in Northlake, Illinois

Allen-Bradley Nema Type 4
STAINLESS STEEL ENCLOSURES for New
Bulletin 709 Motor Starters

NEMA Type 4 Watertight
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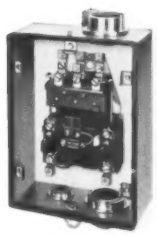
Complete Protection Against Water and Weather!

Allen-Bradley's revolutionary, new line of Bulletin 709 motor starters, which includes reversing switches, multi-speed starters, combination starters, etc., is now available in stainless steel enclosures. Thus the benefits of reduced size, increased interrupting capacity, increased life, and longer trouble free operation can be given to all outdoor installations, or where a great deal of moisture is present. Designed for installation in dairies, breweries, meat and food processing plants and similar locations where a daily "wash-up" is required, the "eye appeal" of these stainless steel enclosures will also be an asset.

The standard Nema 4 enclosures are made of heavy gauge Type 302 stainless steel. However, Type 316 stainless steel can be furnished at a correspondingly higher price. There are many other features about these revolutionary starters that will interest you. Therefore, please write for Publication 6100: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.



BULLETIN 709 SIZE 2
in watertight, weatherproof Stainless Steel Enclosure—for use where a great deal of moisture is present, such as tanneries, food processing plants, pump houses, dairies, breweries, etc., or in outdoor locations.

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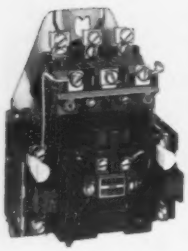
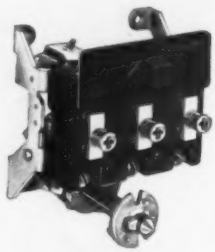
Bulletin 712 Size 1
combination starter with fused disconnect switch in Nema Type 1 enclosure.

The new A-B Series K starter and new A-B disconnect switch in a single enclosure provides complete safety for the operator and the production machine — because the cabinet door cannot be opened until the disconnect is OFF. Also, this "safer" combination starter costs less to install than a separate starter and disconnect switch. There is a neatness about such installations—it is the mark of being up-to-date! Publication 6100 will supply you with complete details—better write for it today: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.



A Starter Design Based on 30 Years of Field Experience

The new Series K starters have been completely redesigned for many *more millions* of trouble-free operations. The new magnet is cushioned to reduce wear. The new molded coil is protected against all harmful atmospheres. The new weld-resistant contacts close without wear-causing sliding motion.



Visible Contact Disconnect Switch

When the front-operated disconnect switch is in the OPEN position, all three contacts are clearly visible as being open. An easily removable insulating guard prevents accidental contact with the incoming lines. The double-break, silver alloy contacts operate with positive snap action.

Safety Cover Latching

The door of the enclosure can be opened *only* when the disconnect switch is in the OPEN position. However, it may be opened by *authorized* personnel while the disconnect is closed by means of a hidden defeater screw. Incidentally, this defeater can be made inoperative.

Extra Safety Padlocking

The operating handle can be locked in the OFF position with as many as three padlocks. When desired, means to lock the disconnect switch lever in the ON position can be provided. In addition, the enclosure door can be padlocked closed, with the handle free to be operated.

Can also be supplied as Bulletin 713 combination starter with circuit breakers

21-61-RM

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Close Fits Without Temperature Control—I

By Culver C Budlong,
supervisor of processing,
Manufacturing Engrg (Missiles),
Lycoming Div, Stratford, Conn.

For years metalworking personnel has been plagued with the problem of compensating for expansion and/or contraction of ferrous and non-ferrous materials, particularly when necessary to machine, measure and fit close-toleranced parts. Various methods have been devised to control or at least to minimize the effect of temperature differentials. These methods fall into four categories:

1. Attempting to stabilize the workpiece and inspection device by immersion in liquid of known temperature, generally the coolant, and rechecking dimensions.
2. Employing a temperature-conversion chart.
3. Roughing out the workpiece and finishing it after an interval thought sufficient for it to return to room temperature. Minimum stock is removed at finishing on the theory that less heat will be generated .
4. Trial and error.

From a quality viewpoint, methods 3 and 4 are not desirable. Method 2 is not practical because:

(a) It does not take into consideration the temperature differential between the actual temperature of the checking gage and the room temperature. Fig. 1 shows the result of a test that shows the variation in temperature between the gage and ambient temperature during a typical 24-hour cycle.

The gage used was a block-type setting master of hardened and ground steel. Its temperature lagged behind room temperature. For example, at 10:30 p.m., a summer storm dropped the room temperature 12 F in 2 hr., but gage temperature dropped only 1 F.

(b) The method disregards the actual temperature of the workpiece immediately after machining. This temperature depends on coolant temperature, stock removal, and type and condition of cutting tools.

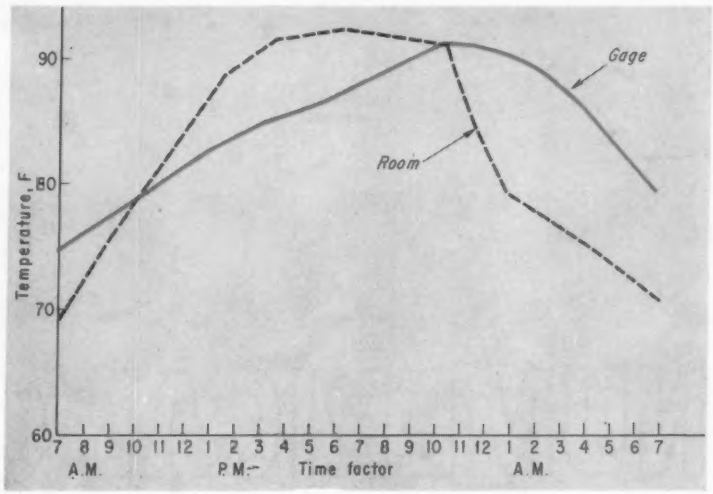

Fig. 1—Gage temperature lags behind room temperature

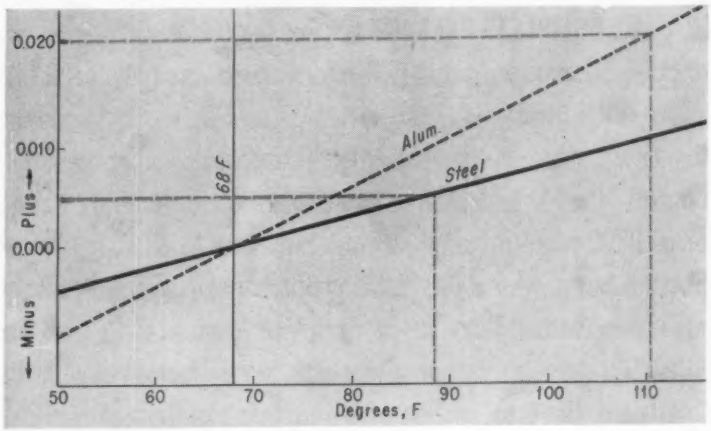

Fig. 2—Linear expansion of steel gage and aluminum forging for 40-in diameter, per degree F. Examples: Gage at 88°, set dial indicator at +0.005 in.; forging at 110°, set dial indicator at +0.021

Method 1 provides some control, if the actual temperature of the coolant is kept constant or continuous readings are taken. But each machine tool has its own characteristics with respect to coolant temperature. Examples:

1. A Lodge & Shipley "T" lathe was used to machine an extremely close-toleranced diameter on a compressor disk. Temperature of room and coolant was 72 F at 8:00 a.m. Room temperature rose during the day to 96 F; the coolant temperature to only 79 F.

2. On an adjacent machine, a Bullard Man-Au-Trol, the opposite condition was noted. At 8:00 a.m. the machine temperature was 72 F; the coolant, 84 F. As the room temperature increased to 96 F, the coolant temperature checked out at 103 F.

Many factors affect the coolant temperature. Some of these are location of coolant pump, its speed, position of coolant nozzle, number and condition of cutting tools, and heat generated by the work spindle. Method 1 is not applicable when machining without coolant nor is it practical for

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Close Fits Without Temperature Control—II

inspection or assembly operations.

All four methods leave much to be desired. It is obvious that an accurate and foolproof method of compensating for linear expansion must be adopted. A temperature-controlled room is excellent for inspection purposes and machining of small parts, but does not completely eliminate the temperature rise in workpieces exposed to long machine-cycle times.

It can be assumed that in order to eliminate the linear expansion factor we must be concerned with the actual temperature of both the workpiece and the measuring device.

The following procedure has been used successfully on assignments involving all types and sizes of machine tools, materials and shop conditions.

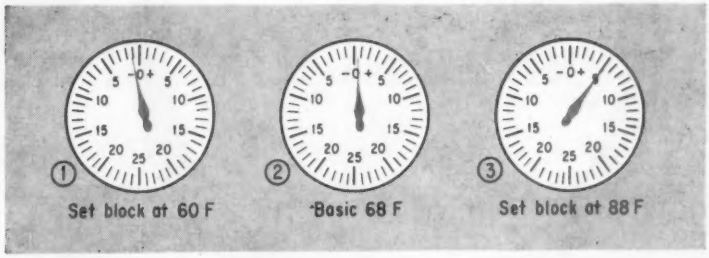

Fig. 3—Correction factors for dial of set block gage: Example 1—at 60 F, dial is set 0.002 in. under size; Example 2—at 68F, dial is set at zero; Example 3—for gage at 88 F, dial is set at +0.005. Correction factors are derived from Fig. 2

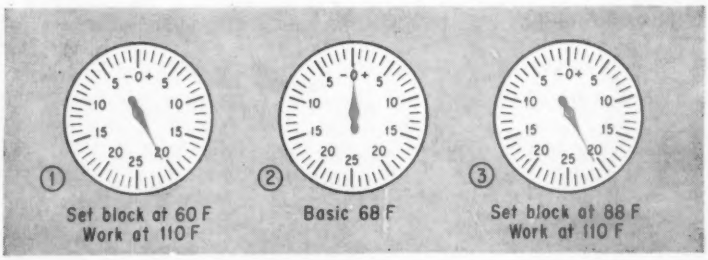

Fig. 4—Readings for work temperature of 110 F: Example 1—gage at 60 F, dial set at –0.002; work machined to +0.021 (see Fig. 2). Example 2—Gage and work at 68 F basic; dial set at zero; Example 3—gage at 88 F, dial set at +0.005; work at 110 F, part cut to +0.021

Example:

Assume that we are required to machine a locating diameter (40.000±0.002) in an aluminum forging. To check size we will use a master setting gage with a dial-indicator length gage. The following steps are required:

Step 1:

With a pyrometer determine the actual temperature of the master set gage, just prior to measuring the workpiece. Using the linear expansion factor for the material of the master gage (steel is 0.00000633 per unit length per degree F), we then compensate by zeroing out the dial indicator, plus or minus, from 68 F. Fig. 2 is a typical chart that should be prepared by the Manufacturing Engineering Department to eliminate calculations in the shop.

Assure that the pyrometer shows the master setting gage to be 88 F (see Fig. 3—Example 3). Using the temperature chart (Fig. 2) we note that +0.005 in. is the correction factor to be used for this temperature. We then set the dial indicator +0.005 in. from zero as shown in Fig. 3—Example 3. This means that, if the master setting gage could be returned to 68 F, the dial indicator would read zero.

Step 2:

Check the temperature of the aluminum forging. It is 110 F. Again, using the expansion chart in Fig. 2, we find the correction factor is +0.021 in. This means that the workpiece should measure +0.021 in. over the zero setting of the dial indicator in order for it to be basic, when and if the part returns to a temperature of 68 F (Fig. 4—Example 3). It should be noted, that the +0.005 in. adjustment made on the dial indicator reading (Step 1) has no bearing on the final reading at this time, for if it were possible to maintan the gage at 68 F this correction factor would not be required.

Example 2 in Figs. 3 and 4 shows a condition where both the gage and workpiece are at 68 F (an unusual case).

Example 1 on Figs. 3 and 4 shows that the gage checks out at 60 F (commonplace in winter months) and the aluminum workpiece is again machined at 110 F. Note that the adjusted dial indicator setting is never considered when checking out the workpiece.

It may appear that the initiation of this measuring system will impose additional hardships on processing, manufacturing and inspection personnel. However, the extra few minutes spent in accurately checking the required engineering tolerances will result in improved quality as well as considerable cost savings. •

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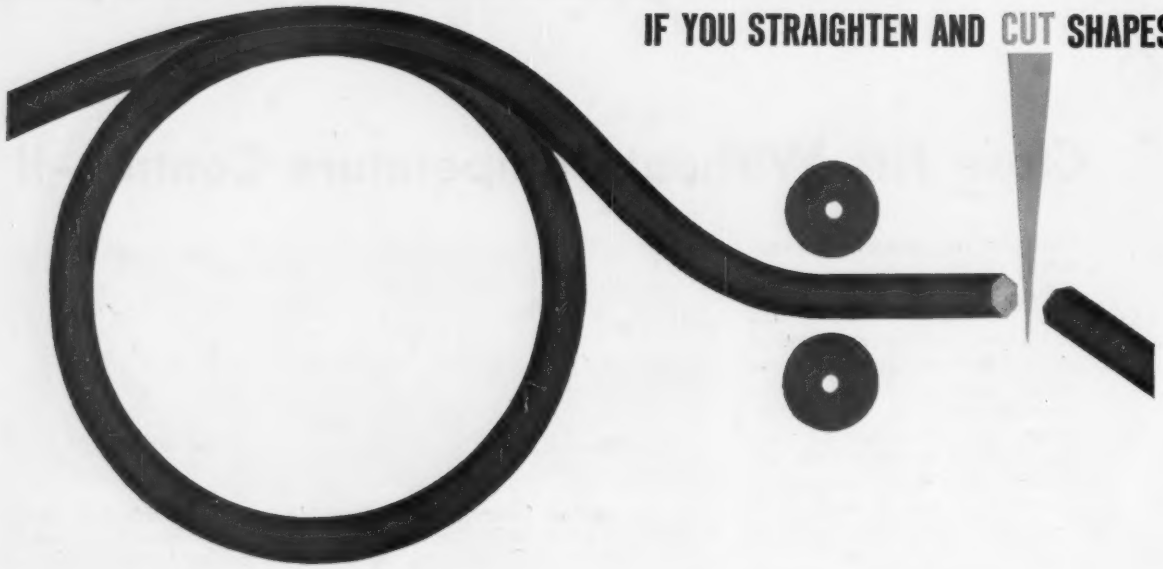

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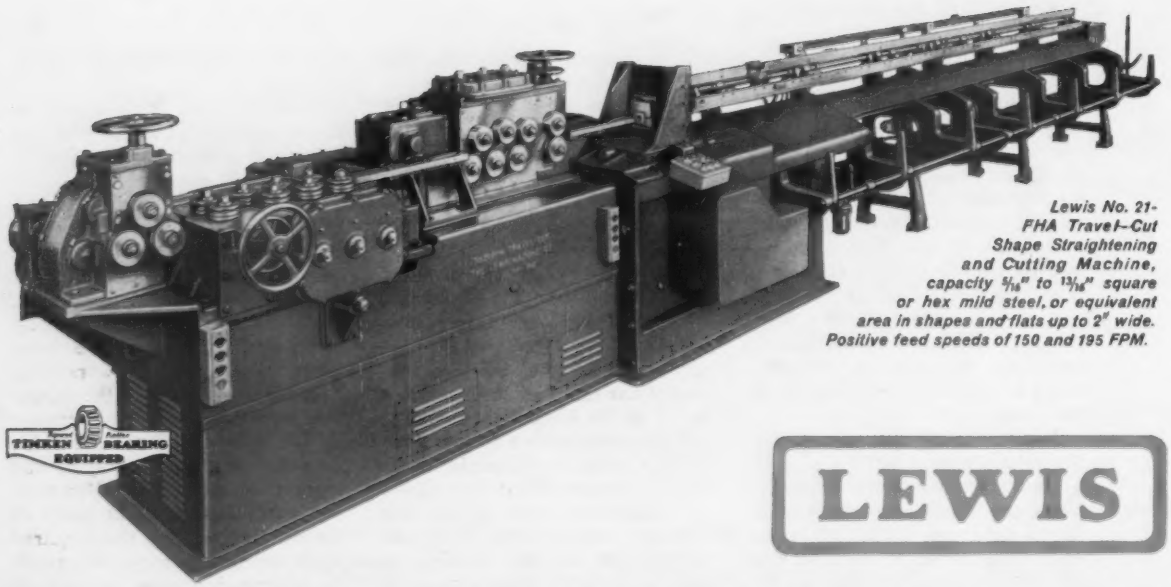

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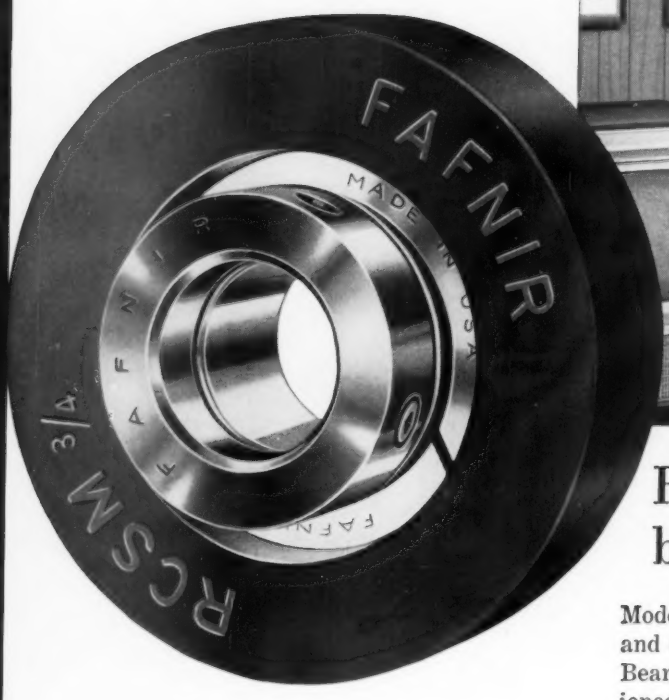

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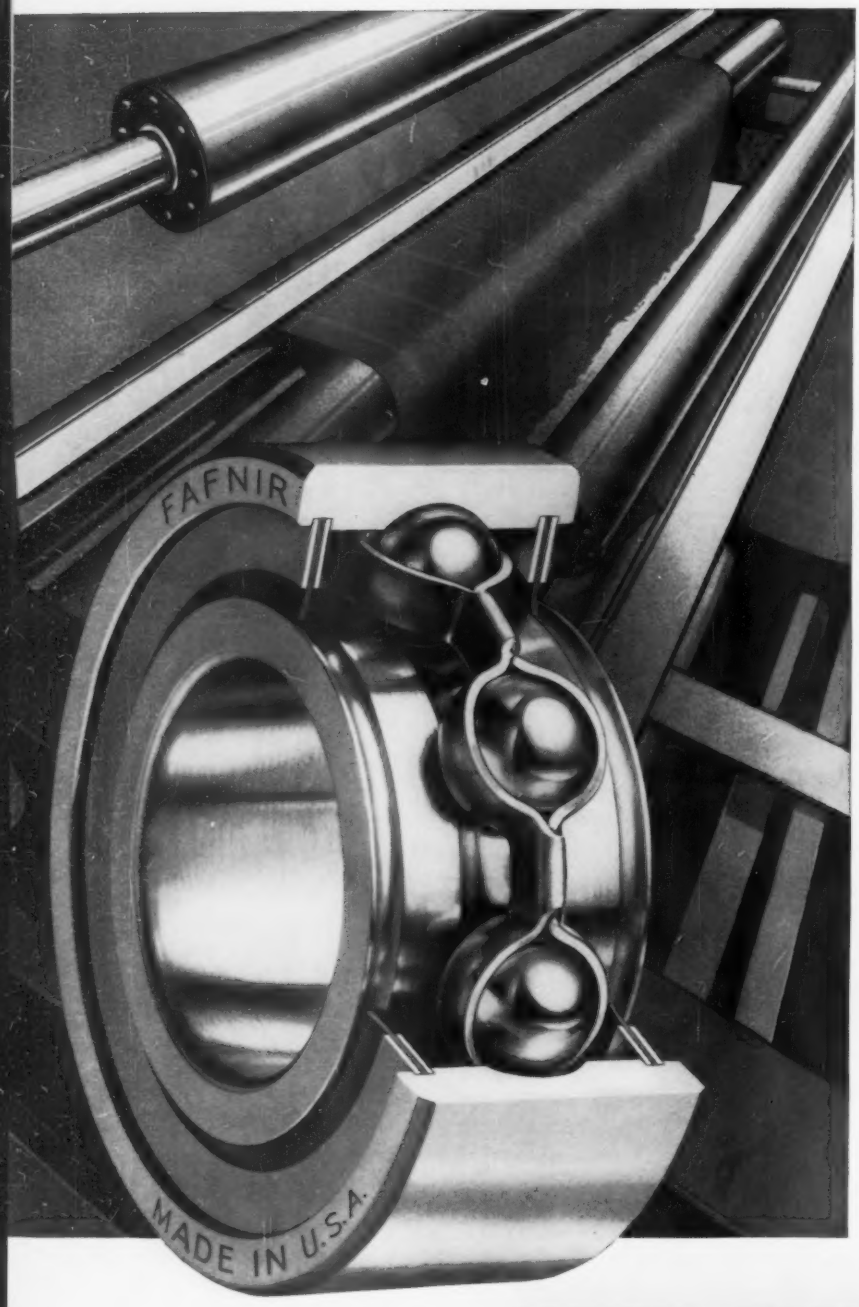

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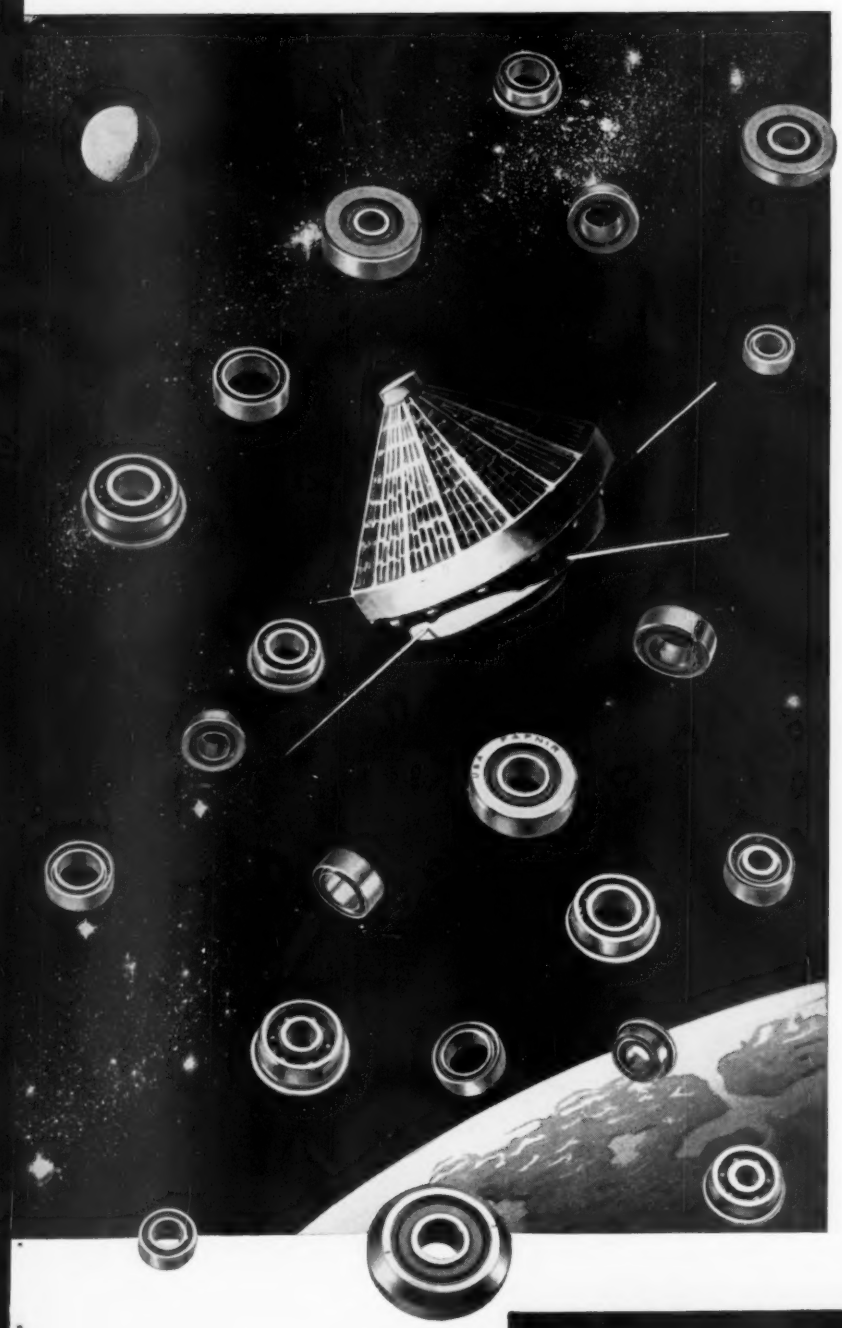

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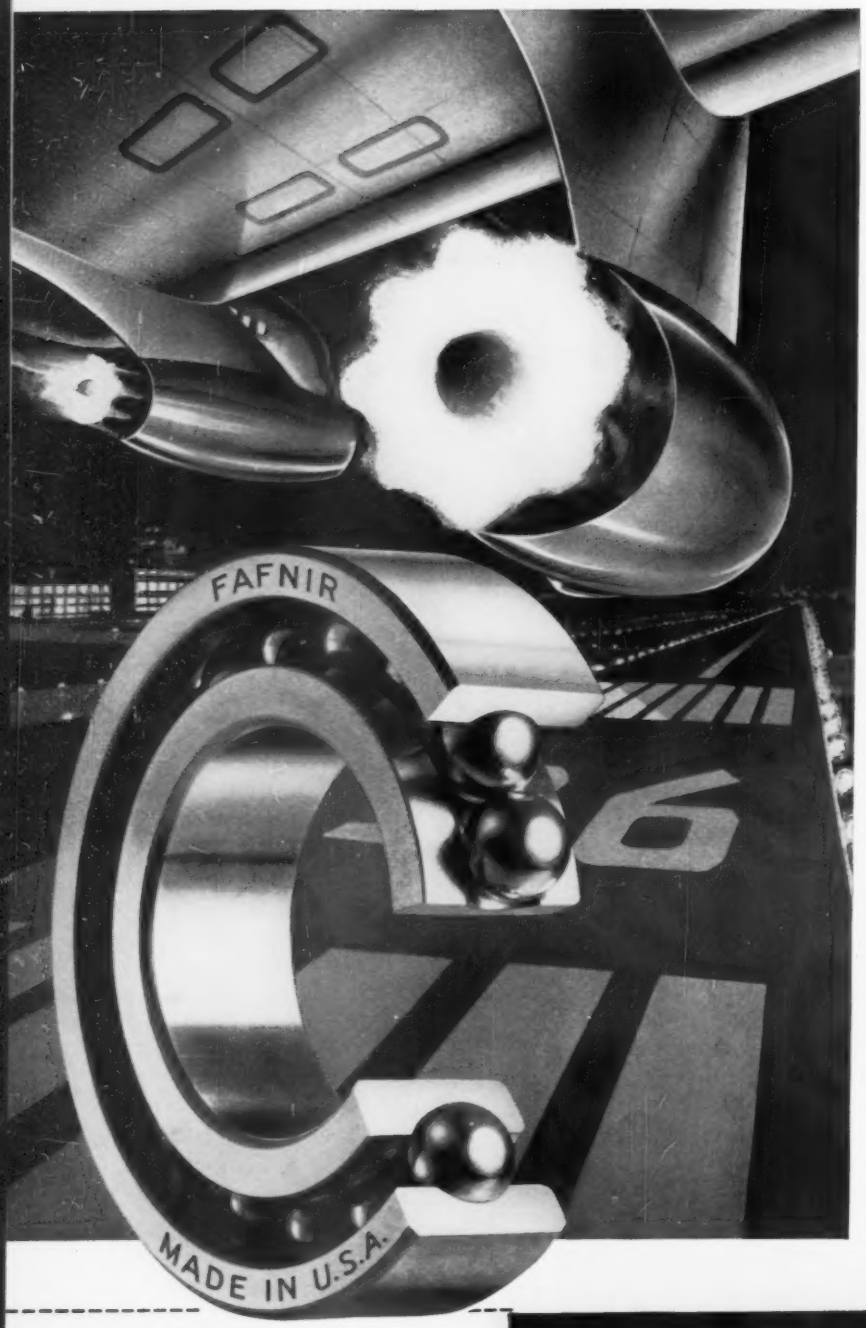

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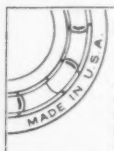

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Talking Shop

Revolt Against Girls

ENGINEERS who go to an industrial exposition want fewer pretty girls in the booths and more technically qualified people who can answer questions. They find it irritating, if they have traveled a long distance, to have questions referred back to the home office for an answer.

This was among the major points turned up in a recent study of visitors to the Design Engineering Show. The survey was made by Clapp & Poliak, 341 Madison Ave, NY 17, the firm that produces this and many other industrial expositions. Nine major conclusions emerge in the report of the survey, all pointing toward a desire for useful facts rather than showmanship.

Lest anybody conclude that these engineers aren't quite normal, we might point out that they asked for fewer pretty girls—not no pretty girls.

Mag at Bat

CAST MAGNESIUM bats have been tested by a number of major leaguers over the past season, reportedly with excellent results. Performance of the plastic covered metal bat is said to be at least as good as the traditional wooden weapon with the added advantage that they eliminate "sting." Metal bats are also said to be more uniform in weight and hardness than the white ash bats and are given a good chance to capture a piece of the 6-million-a-year bat market.

Kudos

AN IMAGINATIVE approach to the education of employees on the need for automation has been taken by one company. A recent issue of *Westinghouse News* carried a story on automation under the heading "Here are some of the things our competitors are doing." The spread showed five illustrated case histories of automation in five plants that compete with Westinghouse.

The next issue of the fortnightly *News* carried a story showing how Westinghouse was automating its own plants to meet the challenge of competition and how the building of equipment for automation is a major part of the business. "Some 20% of the company's total sales [this year] will be in products supplied to our customers for automation projects in their own plants."

Sometimes we see signs that a firm approaches this problem by pretending that it doesn't exist, by refusing to discuss what it is doing, or even claiming it is not doing it. The Westinghouse approach strikes us as unusually sound and well handled.

Quiet Coolant

THIEVES IN DENVER used chilled milk from the refrigerator of a supermarket to cool the blade of their saw when they cut open the safe in the same store. The news reports do not say what the cutting speed or the blade life was. It is evident, however, that the new coolant is useful for quiet machining.

Cold Intake

MOISTURE in compressed air is a problem for most plants that use such air. Filters at the compressor and in the line are a help if properly maintained, but the problem remains.

A new approach is to remove the moisture from the air before it is compressed. The Coblentz system chills the air to 40 F and dries it before feeding it to the compressor intake. The air is heated in the compressor, and can be left hot, since it is not necessary to cool it after compression to collect condensation.

The Coblentz system is said to boost compressor output by 1% for each 5° temperature drop at the intake. If you want to know more about the system, circle Item 50 on the Readers Service Card and we will ask the manufacturer to send you a bulletin.

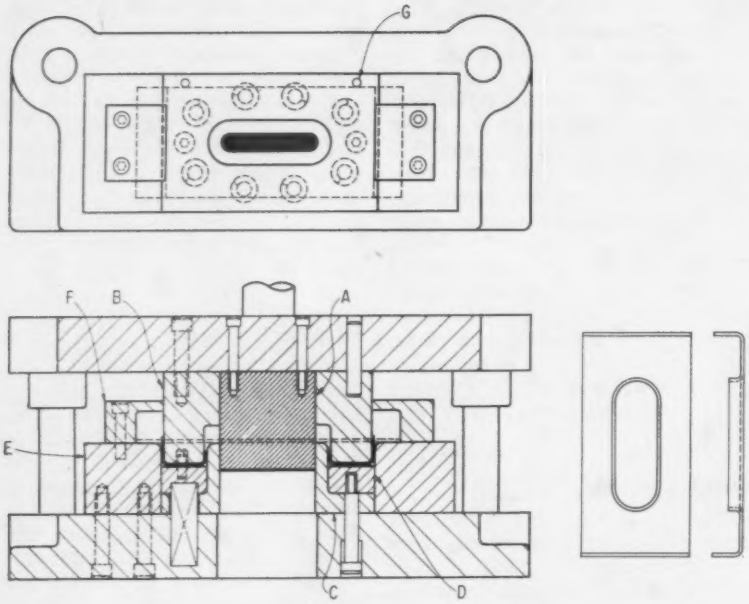
Misplaced Credit

ASTRONAUTS tend to get all the credit for space flights and they certainly deserve credit for courage and perhaps for faith in the abilities of the people really responsible for the flights. But protests E C Easton of Rutgers, "Let us have at least a faint cheer for the engineers who designed, built, launched, and controlled the vehicle in which these space passengers rode . . . The scientific principles which govern space flight are few and simple. The engineering application of those principles to accomplish a successful flight is incredibly complex."

Dean Easton made these comments in a recent issue of *Engineer*. We agree with him, but we fear it is a hopeless plea. Probably more people remember the name of the captain of the plane that dropped the first A-bomb than the names of the men who developed the bomb. And who knows who built the *Pinta*, the *Nina*, and the *Santa Maria*? •

Practical Ideas

Combination Die Punches, Extrudes, and Forms



With this die, parts are produced in one operation from precut blanks of 0.050-in. brass strip. A slot is punched and extruded in the center, and ears are formed up at each end.

Blanks are positioned against two stop pins *G* and between two stripper fingers *F*. The punch *A* makes first contact with the blank and punches out the slot. As the ram descends, the extruding and forming punch *B* wipes the stock around the die block *C* attached to the bottom shoe. A spring-loaded pressure pad *D* surrounds block *C*, and bottoms and wipes up the two ears at the same time with the form block *E*. The stripper fingers *F* strip the part off the punch.

The punch *A* is bolted directly to the upper shoe, instead of being provided with a head recessed into punch *B* in order to facilitate its removal for sharpening. This also simplifies manufacture.

Roger Isetts, Kenosha, Wis

Oscillating Fixture Aids Cam Cutting

The fixture shown here is a self-powered unit designed to be used on a Bridgeport mill for cutting barrel cams. It consists of a heavy base which is clamped to the machine table and may have keys attached for alignment with the table slots. Two vertical members are welded to the ends and are fitted with bronze bushings for the main shaft.

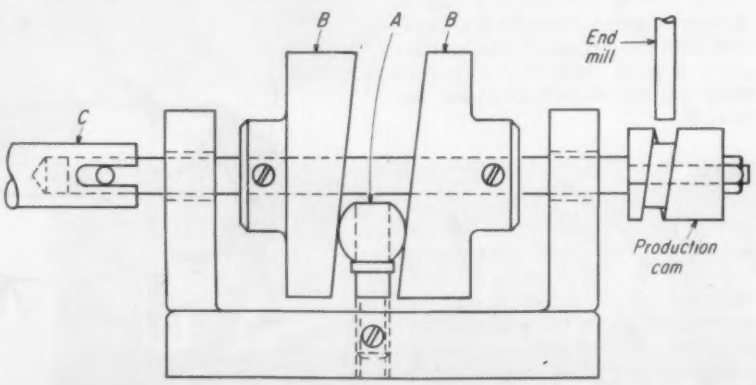
A free-running ball *A* is mounted on a shouldered stud screwed into the base. The stud can be adjusted up or down to vary the distance between the center of the shaft and the center of the ball, and can be locked by a setscrew. Two cams *B* are mounted on the shaft and secured by setscrews. As the shaft rotates, it will be caused to oscillate by the action of the inclined cam faces bearing on the ball, and the amount of this oscillation will depend upon the distance between the centers of the shaft and ball.

One end of the shaft is cross-drilled for a drive pin that engages a slot in the end of the driveshaft *C*. This shaft is drilled a slip fit for the main shaft, the hole being deep enough to allow for full oscillation. The drive shaft is rotated by a ¼-hp motor and either a small gear reducer or a V-belt and sheaves to give a speed of about 20 rpm. The motor and drive mechanism are mounted on a plate secured to the end of the machine table.

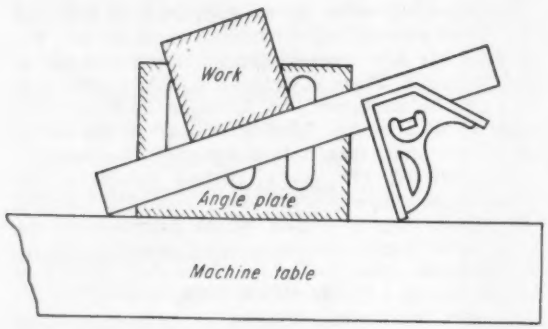
The opposite end of the shaft is made to suit the work. In our case, the production cams have a 0.375-in. reamed hole, so we turned the shaft to suit, threaded the end, and fitted a nut to secure the work. In other cases, a chuck or collet may be used.

The width of the cam track is controlled by setting the table stops, and the amount of throw by adjusting the height of the ball.

F A Nelis, Dania, Fla



Combination Square Serves as Sine Bar



Most machinists cannot afford to buy their own sine bar, but here is a "Poor Man's Sine Bar" that will be found very useful on the milling machine table. The ordinary protractor is frequently awkward to use because the base must be placed some distance to the side of the work. And the work cannot be bottomed on the blade without serious risk of changing the adjustment. Moreover, the protractor must be held carefully to prevent it from falling over.

A good combination square used as shown here overcomes these disadvantages. It is easy to set for the required angle to somewhat better accuracy than can be obtained with an ordinary protractor.

To use it, measure exactly the distance from the inner edge of the blade to the end of the 90° edge of the head. Then, by referring to standard trigonometry tables, it can be determined to what length to set the blade to obtain the required angle.

Length of blade = length of head × cotan of angle.

The angles and the degree of accuracy obtainable depend, of course, on the individual square. With a common square having a head length of about 3.4 in. and a 12-in. blade, it is practicable to work within a range of 18 to 45°. An error of 1/64 in. in setting the blade will result in an angular error of less than 2 minutes in an 18° angle, or 5 minutes at 30°.

We have found this idea to be so useful that we ground off an old square head to a length of exactly 1 in. With an 18-in. blade we can set this for angles of less than 4°. In addition, it enables us to read the blade length setting directly from the table of cotangents without having to bother with multiplication.

E T Feller, Seattle, Wash

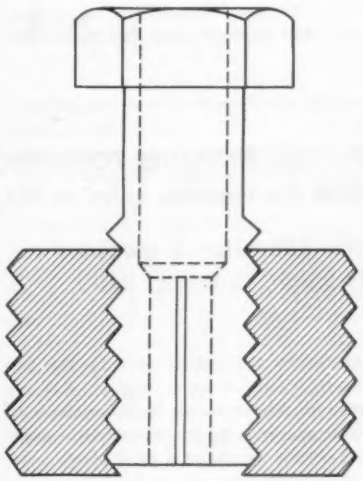
Expansion Screw Pulls Bushings

I had to remove some internally-externally threaded bushings that had been screwed in so tightly that they resisted all ordinary efforts to move them. Then I hit upon this idea which worked like a charm.

I took an ordinary capscrew that had the same thread as the hole in the bushing, and made up a steel pin with a rather long chamfer on one end. Then I drilled a hole lengthwise down the capscrew, making it about 0.015 to 0.020 in. smaller than the diameter of the pin. From the head end I opened up the hole to a slip fit for the pin, deep enough to extend just below the top of the bushing when the capscrew was screwed all the way in. Across the lower end I made a saw cut as long as the small-diameter part of the hole.

I put the screw into the bushing, and then drove the pin in hard. This expanded the end of the screw and gripped the bushing so tightly that it could be removed by using a wrench on the head of the screw. The same idea will also work on studs if you drill and tap a hole in the end.

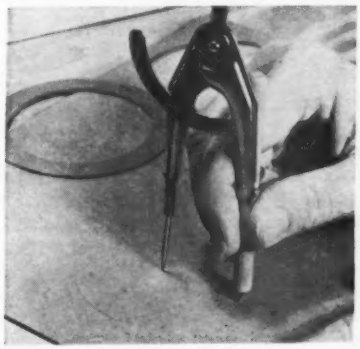
Robert Moore, St Louis, Mo



Tip on Gasket Cutting

If a proper gasket cutter is not available, you can do a very good job with an ordinary school compass. In place of a pencil, use a short piece of wood dowel; cut a slot in the end of the dowel and force into it a little corner broken off the edge of a single-edge razor blade.

Robert Micals, Freehold, NJ



Seltzer Fixes Ceiling Bolts

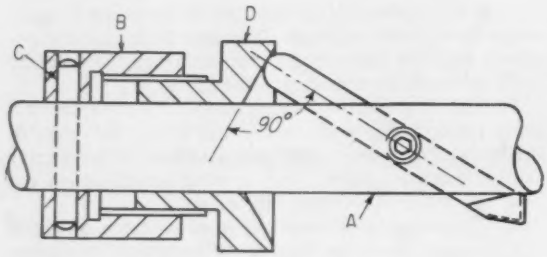
Fixing foundation bolts to a concrete ceiling is an annoying and almost impossible job when ordinary cement and sand are used, no matter how little water is used in the mix. Even when the cavity is well soaked with water and deeply undercut, the mixture will not always stick and prevent the bolt from dropping down.

However, if you make a mixture of cement and soda water, no sand, and use just enough soda to make it workable, the bolt will stick tightly with no fear of its dropping.

J A Waller, Dartford, England

Practical Ideas

Cone Adjusts Boring Tool



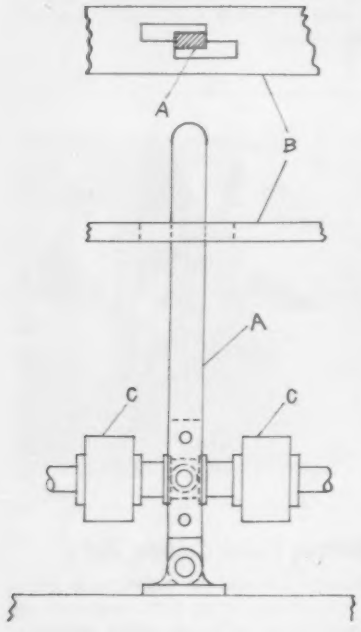
On job shop and toolroom work on a horizontal boring machine it does not usually pay to make up special boring bars and, on sizes under 1¼ in. the usual practice is to tap the end of the tool for adjustment.

The adjusting collar shown here permits precision adjustment without major modification of the bar. The standard bar A is cross-drilled for a drill-rod pin to hold the nut B. There is virtually no load on this pin, so it can be quite small in diameter. The adjusting collar D has a conical opening to bear on the end of the toolbit and cause it to advance as the collar is moved forward. The conical surface should be case hardened, and the end of the toolbit should be rounded.

A witness line is scribed on the bar, and the OD of the collar is graduated to permit a precision amount of movement when the collar is rotated. On a 1-in. dia bar we use a 2½-in. dia collar and a 20 tpi thread. This gives adjustments of 0.0005 in. without straining the eyes.

J A Waller, Dartford, England

Gate Stops Accidental Reverse



On a reversible drive in our plant there are two clutches operating in opposite directions. To reverse the machine, one clutch is disconnected by moving a lever, and a brake is automatically applied. The operator must then wait until the machine stops before engaging the other clutch. In an emergency, the operator pulled the lever hard over, allowing the second clutch to engage before the machine had stopped, and stripping several gears. To prevent a recurrence, we made up a safety gate, as shown here.

The clutches *C* are engaged by a sliding spool operated by the lever *A*. The bar *B* which we installed has a Z-shaped slot through which the lever passes. Regardless of which clutch is engaged, the direction cannot be reversed accidentally because the gate interferes and stops the lever at the midpoint or neutral position. In this position, the machine cannot be started accidentally because the lever must be sprung into one or other of the straight portions of the slot before it can be shifted.

L Kasper, Philadelphia, Pa

FIXTURE SIMPLIFIES ECCENTRIC GRINDING
Was the winning entry in the Aug 21, 1961 issue.

The $25 prize is awarded to:
H Singh, Calcutta, India

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

PAYMENT—will be made as soon as tabulation is completed, and is in addition to the regular rate for the item published.

JUDGES—are a group of American Machinist/Metalworking Manufacturing readers who select articles they prefer in a particular issue. The group changes entirely with each issue and thus represents a true cross-section of readers. Their decision is accepted by the editors, without reservation or bias, as final in each case.

REQUIREMENTS—Items must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with AM/MM standards, and readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: Practical Ideas Editor, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY. Please make sure that your name and address are included.

Philo H Danly

In less than 40 years, this paterfamilias of Chicago's press-building Danly clan (there are eight of them in the business) has parlayed an idea of his father's—standard die sets—into a $38-million-a-year business. Recognized as "one of the true mechanical craftsmen of his time," he combines a fetish for quality with a flair for salesmanship and managerial ability of a high order.

Pressbuilder

In the winter of 1923, a familiar sight in manufacturing towns along the New York Central RR tracks was a young Chicagoan who tramped through knee-deep snow with two bulky bags in tow.

One of the bags contained his clothes: The other was filled with objects that caused many a toolroom foreman to ask, "Say, what do you get for these things?"

The "things" in Philo Danly's bag were the first standard die sets with interchangeable parts, the brainchildren of Philo's father, Robert C Danly, who headed up Chicago's struggling young Danly Machine Specialties Inc.

It wasn't to struggle for long. When young Danly returned, he carried with him enough orders for the die sets to mount a boom of small proportions. New employees were added, and the little one-story plant hummed with activity. Only a few months before there had been doubts about its survival.

That was nearly 40 years ago. Today, the company is one of the largest producers of precision-built die sets and diemaker's supplies in the world. But that's only a fraction of the firm's overall business. The bulk of it is in press building, which Danly entered after World War II.

Philo Danly is not one to quibble over who's No. 1 in the press industry. There is no doubt in his mind—Danly is. Not one to mince words, he says, "The press business is not an easy one. You have to go out and live with the people who use them. You have to find out what they want and give it to them. We'd rather lose a sale than give them something they don't want."

A family affair

Such highly personal philosophy has long dominated the company's way of doing business, because (at least in part) the Danly family has dominated its management.

Philo Danly is president and chief executive officer. And let's see—there's his mother, who serves as secretary and a director; brother James, engineering VP and a director; son James, who's VP manufacturing and a director.

Then there's son Donald—vice president for press sales; son John, who's in charge of European operations; brother Robert, who is vice-president for die set and diemaker's supplies; and another brother, Wayne, who is a die set salesman. Another brother, George L Danly, Sr, was senior vice president, died a little over a year ago after serving for 36 years with the company.

Occasionally, shareholders have questioned this high proportion of Danlys in the company. Philo's typical response: "Can you show me somebody who can do a better job?"

A longtime associate characterizes Philo Danly as "one of the true mechanical craftsmen of his time . . . never happy unless he can make the best possible press."

"Profit is not his first considertion," he adds. "Sometimes this has meant losing money on a sale because Philo has insisted on making improvements after the order has been accepted at a price."

(Continued on next page)

Mechanical perfection has always come first with Danly. Growing up in the bustling Lawndale section of Chicago's West Side, he got his first taste of mechanics at Crane Technical High School.

His mechanical aptitude he inherited from his father, who was at one time or another in the bicycle business, in charge of toolrooms at International Harvester's McCormick Works, a maker of magnetos and roller bearings (IH bought him out in 1916).

Farms were just beginning to be mechanized when Philo graduated from high school, so he took his first job with Harvester's experimental testing group—at the princely sum of 10¢ an hour.

After four years of this, Danly enrolled at the University of Illinois as a mechanical engineering student. The year was 1916, and Europe was at war. When it began to appear that America might become involved, Illinois' Dean of Men suggested that those who had passed their first year might serve their country better elsewhere.

Young Danly took the hint, got a job with the old Curtiss Aeroplane & Motor Co, Buffalo, joining a small group of engineers working on experimental aircraft.

Curtiss contracted to design and build a big four-engine seaplane capable of transatlantic flight, and built a plant at Garden City, Long Island, to do the job.

Pioneer flight engineer

Danly, who was still in his very early Twenties, was named project engineer in charge of the drafting end of plans for the NC-1. As World War I "hotted up," he enlisted in the Navy, but word soon got around that he had worked on the NC-1 and he was put back on his old job, only this time in uniform and at a gob's pay (by then the Navy had taken over supervision of the job).

After helping set up test flights for the NC-1, Danly, who had never before flown in a plane, was appointed flight engineer on the plane's maiden flight in the fall of 1918.

"My job was to fix anything that happened—if I could," says Danly. He also flew in the NC-2 at a later date. Ultimately, one did fly the Atlantic.

When the war ended, Danly, figuring he'd "had an education" at Curtiss Aeroplane, didn't return to school. Instead, he went back to Harvester in Chicago, where he was destined to take part in another "first flight"—that of IH's Farmall tractor.

Meantime, Danly, now married and father of a son, began to think about ways to enlarge his income. He decided, after consulting his father, to open a shop of his own, and in the summer of 1922 Danly Machine Specialties was born at 4911 Lincoln Ave, Chicago.

Standard die sets

It was slow going for some months, then Philo Danly, on his way back from engineering meetings in the East, began calling on metalworking firms with samples of the standard die sets conceived by his father.

Although this was a novel idea at the time, it found ready acceptance in the East. Western companies, at that time not so accustomed to using pins and bushings, took to the idea later—even automotive companies.

As orders began to come in, Philo Danly started spending most of his time selling, although he was vice president and general manager of the firm (his father was president).

Even during the depression years, Danly Machine Specialties throve, making die sets and machining parts for farm machines. By 1936 the company needed to expand, and five acres of land and some buildings were purchased in Cicero, Ill, a suburb of Chicago.

Depression or no, Danly machine started to branch out. For instance, arc welding was still in its infancy, at least in the Chicago area, when the company began flame cutting steel plate, then making die shoe weldments. Out of this came out a contract to supply Vickers Inc with welded parts for pump housings and transmission cases. Later, this experience paid off in World War II, when Danly contracted to weld and machine 5-inch and 40-mm antiaircraft gun mounts.

A pressbuilder is born

After the war, the Navy sold the new plants to Danly, which with its new capacity was in a good position to take advantage of the crying need for all kinds of capital equipment. Press makers were swamped with orders, and Danly began making presses for other makers.

Why build presses for others? Philo Danly asked himself. The advantages of going into the press business were obvious: the firm didn't have to worry about obsoleting presses already in existence with the Danly name on them; it had the beginnings of an engineering department, and it had the equipment.

For months after the decision had been made to enter the press business, Philo Danly "lived outside" the company—talking with the big automotive stampers and others to find out what presses they wanted.

He was in the beginning the only press salesman Danly Machine Specialties had, and he's "still the best."

Danly's idea was to design presses "for deflection rather than strength of materials," and he made no bones about telling users that they would have to pay the price to get the kind of equipment they asked for. Industry was willing to pay—the first big automotive press with the Danly name on it was shipped to Chevrolet.

Today, Danly's press business is three or four times as big as its original business, die sets.

Currently, Danly has about 1900 workers (at peak capacity there are 2500 on the payroll), and Philo Danly admits he's not happy "unless we are running three shifts, six days a week."

"A full-time job"

Sporting a 35-year pin in his buttonhole, Danly is likely to show up at 8 am, impatiently looking for work to be done. Today 66 years young, Philo Danly refuses to slow the hectic pace he has maintained for years, "Staying with the demands of the press industry is a full-time job. Not only that, we're always looking for compatible new products . . . Always have half a dozen brainstorms going."

Although he can still leave visitors huffing and puffing behind him on a tour through the plant, his associates say that Danly is inevitably relaxing his grip just a little—enough to take up such outside interests as fishing. He's having a boat built to use next winter at his home in Stuart, Fla.

Another important outside interest is his 200-acre farm near Charlevoix, which he bought in the early 40s, and where he spends as much time as possible in the summer. Incidentally, Danly employees and "special friends" receive a supply of maple syrup and pancake flour from the farm.

But farming and fishing to the contrary, Philo Danly has no intention of giving up the work he loves. "Anyone who thinks I'm not going to keep on working is crazy—I've got a patent on it!"•

Names in the News

E W Bliss Co has named **N Laurence Desmond** factory manager of the Hastings (Mich) Division. He was formerly plant manager of the Borg & Beck Division of Borg-Warner Corp

Logansport Machine Co, Logansport, Ind, has named **H L Stewart** vice president and sales manager. He has been serving as manager of Scott Industrial Equipment Co of Indianapolis for the past year and a half and, prior to that, was associated with Logansport for 17 years.

Burgmaster Corp, Gardena, Calif, has elected **Joseph L Burg** president. Formerly vice president, sales and engineering, he succeeds **Fred G Burg,** who will serve as chairman of the board.

Circo Corp, Clark, NJ, producer of industrial cleaning equipment, has appointed **Jack L Pettit** director of manufacturing. He was formerly chief manufacturing engineer at Carr Fastener Corp, Cambridge, Mass.

Wheel Trueing Co, Detroit, has appointed **Donald J Wallace** vice president, sales, of the Detroit Tool Sales Division. Mr Wallace is vice president, manufacturing, of Wheel Trueing

Thomson Electric Welder Co, Lynn, Mass, has named **Frank L Brandt** vice president of the Lynn Division. Mr Brandt has been active in the resistance welder industry for over 20 years

Fairbanks, Morse & Co, Yonkers, NY, has appointed **B Nevling Clune** vice president and general manager of the Scale Division. He was previously assistant general manager.

Hevi-Duty Electric Co, Watertown, Wis, has named **Roger L Hosfield** product manager of the Oven Division. He comes to Hevi-Duty from Grieve-Hendry Co where he was chief engineer.

Durant Manufacturing Co, Milwaukee manufacturer of industrial counting devices and digital readout instruments, has named **Willard H Brown** manager of manufacturing, supervising the company's entire manufacturing operation now located in Watertown, Wis. Mr Brown was formerly plant manager of the Milwaukee factory.

Jacobs Manufacturing Co, West Hartford, Conn, has appointed **David E Duffy** sales manager. He has been serving as assistant to the vice president, sales

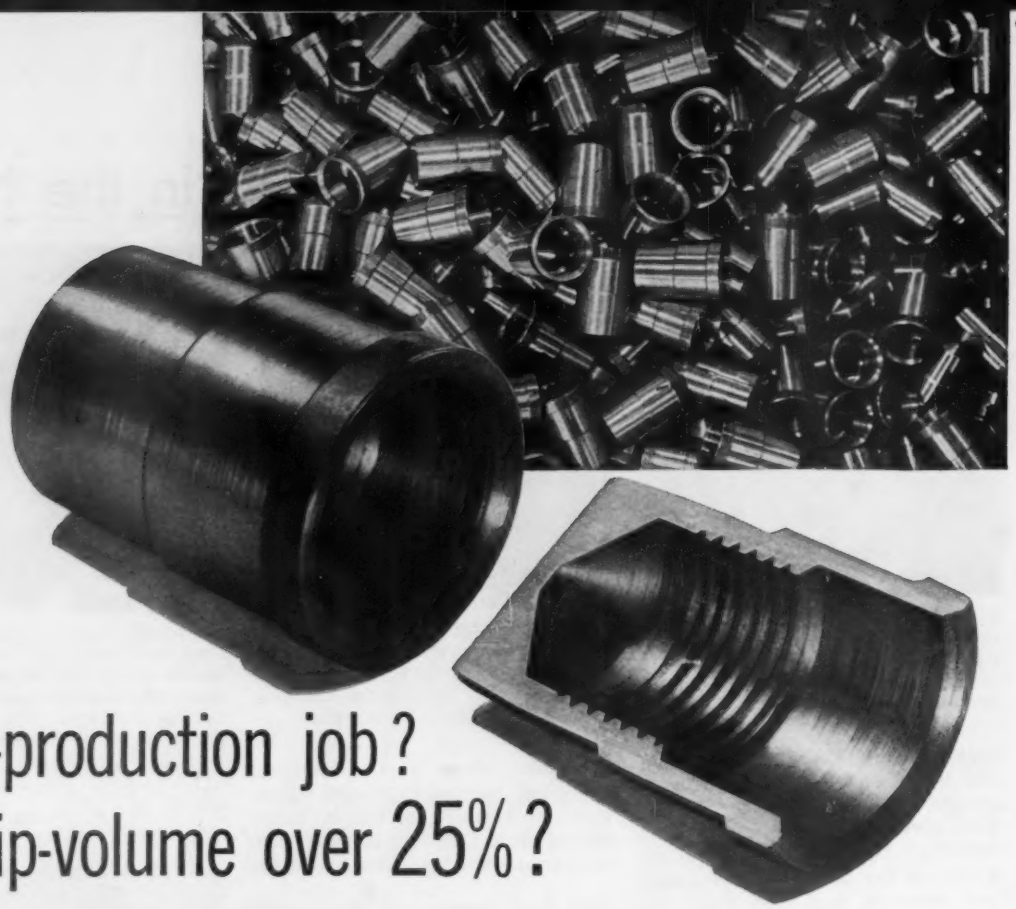
Louis Polk, board chairman of **Sheffield Corp,** and director and vice president of **Bendix Corp,** has been awarded the American Standards Association Howard Coonley Medal for 1961. The award is in recognition of Mr Polk's almost three decades of leadership in establishing high standards for dimension quality control

National Automatic Tool Co Inc, Richmond, Ind, has appointed **W K Ginman** sales manager of the Induction Heating Equipment Division. Mr Ginman has been Detroit District manager for Tocco for the past fourteen years

Emhart Manufacturing Co, Hartford, Conn, has appointed **George F Crosby Jr** manufacturing manager of its Hudson, NY, Division. He served previously as manufacturing manager at Hewitt-Robins Inc, Conveyors Division, in Passaic, NJ.

Mack Trucks Inc, Plainfield, NJ, has appointed **Joseph I Andreini** acting plant manager of the new facility in Hagerstown, Md. He will continue to be responsible for manufacturing and truck assembly operations at the company's Allentown, Pa, plant.

continued on page 248



High-production job?
Chip-volume over 25%?

BETH LED may be the profit-booster you need

Beth-Led is a high-sulfur, leaded carbon screw stock. It's free-machining . . . and on high-production jobs, where considerable metal must be removed, you can count on it to increase the overall job efficiency.

Of course, your bar automatics must be capable of the high speeds which make Beth-Led so profitable; and if they are, you're right in line for a reduction in job costs when you switch to Beth-Led. Faster machining, longer tool life, smoother machined finish. Beth-Led gives you all these benefits . . . and more.

Independent Distributors Stock Beth-Led

Beth-Led is readily available . . . cold-finished, as distributed by non-integrated cold drawers . . . or hot-rolled, as produced by Bethlehem.

Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Rohm & Haas Adds Extra-High Impact Acrylic to Line of Molding Powders

Implex R, a new grade of high-impact acrylic, has double the impact strength of other acrylics previously available in the Implex line. Moreover, the new grade has a high degree of transparency in natural color and a wide range of color possibilities.

Typical applications include control knobs, electrical appliances, automobile armrests, housewares and sporting goods. Molded parts with wall thickness of ⅛ in. or less in natural color have enough transparency to allow observation of liquid levels in molded containers.

The powder, which contains no plasticizers, is dimensionally stable, low in water absorption, corrosion free, and is said to be odorless and tasteless.

Parts made of the acrylic can be drilled, machined, and solvent cemented and surfaces can be spray painted, engraved, printed, stamped and vacuum metallized.

The addition of Implex R brings the number of Implex powders to five, of which R has the greatest impact strength, A the highest resistance to flexural fatigue, B and C the best moldability (flow in thin sections), and F the greatest resistance to heat.

Rohm & Haas, Philadelphia 5, Pa

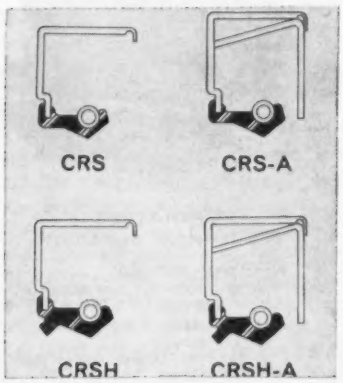
MORE DATA? Circle 90, inside back cover

High Temperature Marking Ink

Marking ink for welding rods and other metal products that are subjected to high temperatures will withstand up to 2500F. Called Okie heat-resisting yellow, the ink is marketed in 1 to 55-gallon drums.

F G Okie, Inc, Ambler, Penna

MORE DATA? Circle 91, inside back cover



Shaft-Type Oil Seal Incorporates New Sealing Member Compound

Design of the CRS seal consists of a spring-loaded sealing member securely bonded to the shell. There are no internal parts to misalign and no avenues for internal leakage. Sealing lip configuration and lip concentricity have been improved over former designs. It is tooled for shaft sizes ranging from ½ to 7 in.

Sealing members are molded of Sirvene (synthetic rubber) compound and are said to be superior in sealing and wear-resistance properties. Special ingredients in the compound also impart excellent low-friction properties to the seal, which is available in four standard configurations.

Chicago Rawhide Mfg Co, 1301 Elston Ave, Chicago 22, Ill

MORE DATA? Circle 92, inside back cover

Rosin Flux Remover is Faster, Cheaper Than Carbon Tetrachloride

Reflux, a new rosin flux remover is 35% faster in operation than carbon tetrachloride and 40% lower in cost, according to the manufacturer.

Tests have shown that Reflux removed flux from printed circuit boards in an average of 6½ seconds as compared with an average of over 10 seconds per board for carbon tetrachloride and three other solvents. The cleaner, compounded of non-organic solvents, is non-flammable, and 1/10 as toxic as conventional cold-cleaning formulations. It is also recommended as a general purpose cleaner for cold-cleaning of greases, waxes, and dirt films from all metallic surfaces. One user reportedly has replaced vapor degreasing equipment with a two-bath sequence of the fluid.

Supracote Development Laboratory, Inc, 17 Main St, Bloomingdale, NJ

MORE DATA? Circle 93, inside back cover

Alcoa Offers Four Aluminum Extrusion Alloys in Ingot Form

Extrusion alloy C914 is a new version of extrusion alloy 6063 and gives a better combination of mechanical properties and extrusion speed. It can be used for producing the full range of hollow and solid shapes and is specially recommended for applications where a matte finish is desired. The alloy is receptive to hard anodic coatings and can be finished in a wide range of colors.

Extrusion Alloy C58 is especially suited for extrusions to be porcelain-enameled.

Alloy 6563, is capable of being anodized to a brighter, more uniform finish than other moderate-strength alloys, and is recommended for trim applications where specular finish is required.

Alloy 4543 is used to make architectural extrusions requiring a gray finish. Offered in three versions, it produces light, medium or dark gray finishes when anodized by the Alumilite process.

Aluminum Co of America, 1501 Alcoa Bldg, Pittsburgh 19, Pa

MORE DATA? Circle 94, inside back cover

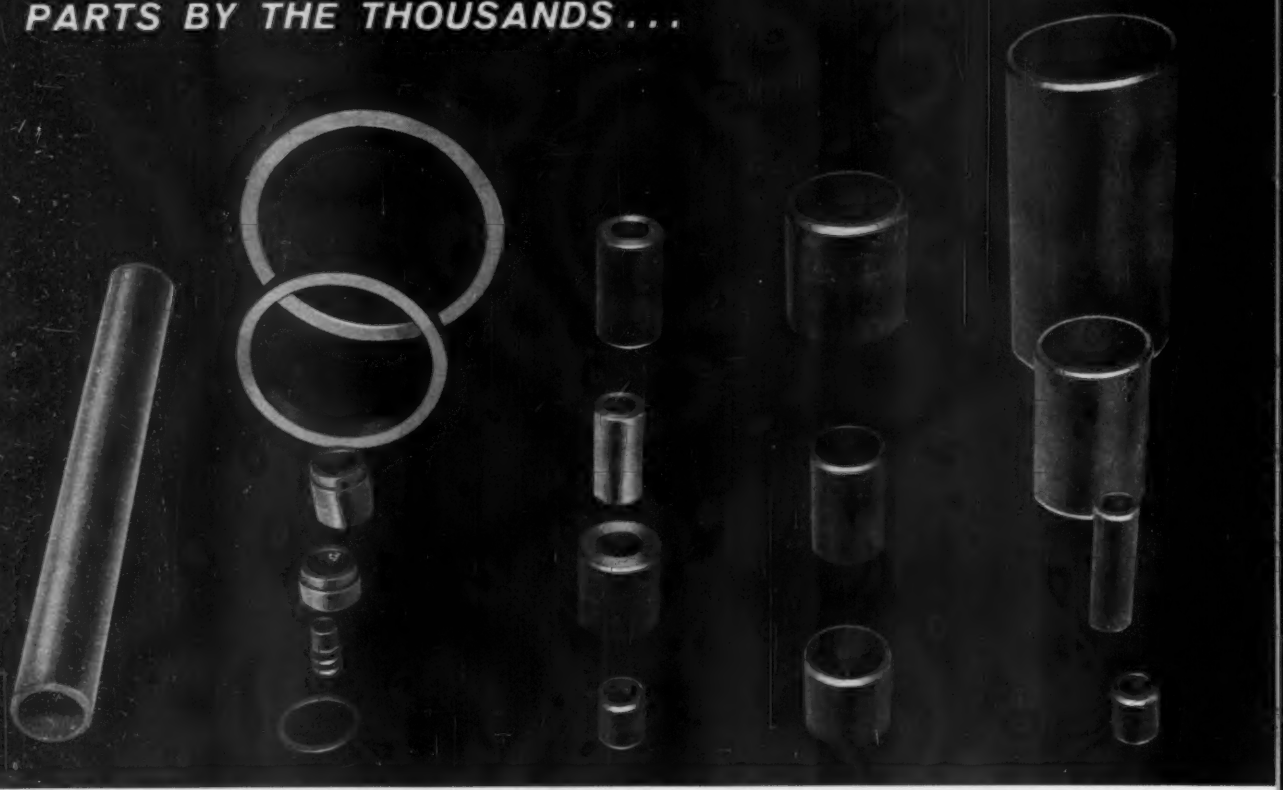
Rubber Replacement Material Resists Abrasion, Acids, Oils

Tuf-Flex a new material with extremely high resistance to abrasion, petroleum products, acids and solvents is said to have at least double the tensile strength of rubber. The material is presently being used in rolls in durometers from 30 to 90 on the A scale and can also be furnished as a coating on sheet metal for forming into ducts that will operate in an abrasive or corrosive environment. The coated ducts reportedly last 10 times longer than steel ducts under these conditions.

Glenwood Industries, Box 254, Glenwood, Ill

MORE DATA? Circle 95, inside back cover

PARTS BY THE THOUSANDS . . .



Left to right: Plastic tubing, rings and formed spacers, coupling blanks, heavy pipe nipple blanks, standard pipe nipple blanks.

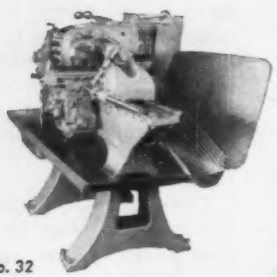
Formed . . . Chamfered . . . Cut-Off on BARDONS & OLIVER Cutting-Off Lathes

Superior Pipe Specialties Co., Chicago, reports a *ten year* profit success using Bardons & Oliver Cutting-Off Lathes.

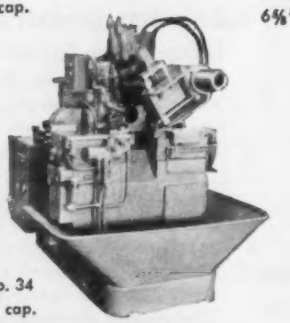
The firm produces parts for their hydraulic equipment plus a wide variety of products on a jobbing basis.

Says Mr. Youhn, Factory Superintendent: "Bardons & Oliver Cutting-Off Lathes are the *only* machines of this type that will stand up under years of hard use. We are completely satisfied with them in every respect."

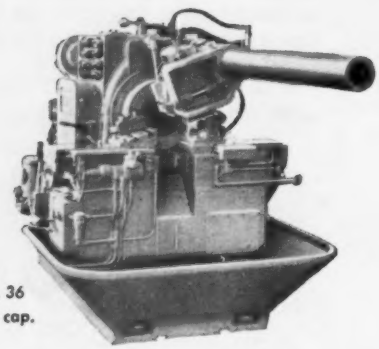
As the above photograph suggests, "versatility" is the name for these Bardons & Olivers. They're unexcelled for forming, chamfering and cutting-off tubular or solid bar stock. You realize extra profits by using these outstandingly rugged machines in your plant. Available in collet capacities from 2 to 16 inches, with automatic loading and unloading equipment if desired.
Bardons & Oliver, Inc., 1133 West 9th Street, Cleveland 13, Ohio.



No. 32
2" cap.



No. 34
4" cap.



No. 36
6⅝" cap.

OPERATING DATA FROM SUPERIOR

Typical hourly production
- No. 32 — 4000 - ½" pipe nipples chamfered & cut-off.
- No. 34 — 1082 - 2" pipe nipples chamfered & cut-off.
- No. 36 — 240 - 5" pipe nipples chamfered & cut-off.

Tolerances held on lengths: ±.002"

Average set-up time: 20 minutes

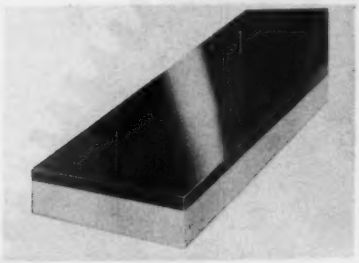
Tooling
High speed steel, carbide or roller cutter, depending on finish desired, material, operations performed and lot size.

Operators Required
2 men operate 3 machines, including setup, loading, and unloading (With automatic handling equipment 1 man can run 3 machines).

BARDONS & OLIVER

Manufacturers of Turret Lathes and Cutting-Off Lathes

CIRCLE 358 READER SERVICE CARD



Ohio Knife Offers Bronze Clad Steel Liners and Wear Plates

Bronze clad die liners and wear plates with a backing of soft steel are finish ground to 0.0005 in parallel and flat. They can be drilled and counterbored through the bronze surface and the soft steel backs can be easily machined to suit a die. A minimum of 3/16 in. of bronze is deposited on all surfaces.

The plates are available in a variety of shapes and sizes and in 17 different sections. Each section is available in 72-in. lengths, in widths from 1½ to 8 in., and in thicknesses from ½ to 1¼ in.

The Ohio Knife Co, Cincinnati, Ohio

MORE DATA? Circle 96, inside back cover

Linde Cryogenic Piping Has Permanent Vacuum Insulation

Cryogenic piping designed primarily to meet aerospace industry needs for improved ground support equipment to handle liquid hydrogen, is adaptable for use with other liquified gases as well. It is available in standard 40-ft lengths of vacuum insulated pipe and fittings in 2 and 4-in. diameter sizes on an off-the-shelf basis. The new design has an Invar steel inner fluid line surrounded by a light-weight stainless jacket. Between the two is a layer of insulation made up of laminate-wrapped alternate layers of aluminum foil and glass fiber. This layer is factory-sealed in a high vacuum that is said to be maintenance-free for the ten-year minimum life of the pipe. The use of Invar eliminates the need for bellows or other contraction-compensating devices because of the low coefficient of expansion of this alloy.

For field erection the Invar fluid line has stainless studs welded onto the ends of each section to permit joining by heliarc welding. Layers of insulation are then wrapped around the joint and the connection completed by bolting a gas-tight coupling together over the joint.

A vacuum is formed in this coupling when the pipe cools to liquid hydrogen temperatures, thereby aiding insulation, and the welded joint is said to allow smoother gas flow than other methods of coupling.

Linde Co, Div of Union Carbide Corp, 270 Park Ave, New York 17, NY

MORE DATA? Circle 97, inside back cover

Pure Polyurethane Coatings Furnished in Single Packages

Pure polyurethane coatings that show high resistance to chemical solvents and oils as well as resistance to dirt, impact, and ozone are now available in single package form. The coatings are offered in a variety of colors as well as clear and can be produced also as hard or flexible and glossy or satin finishes.

No special application techniques are necessary with the coatings, they can be brush dip, flow, roller, or spray applied over all types of rigid surfaces.

Commercial Development Dept, Hugson Chemical Co, Erie, Pa

MORE DATA? Circle 98, inside back cover

Rust Remover and Neutralizer Prepares Steel For Painting

IFCO No. 101 rust remover and neutralizer prepares the surfaces of ferrous metals for coating without the need for sandblasting or heat treatment. The product can be applied by brush or with a rag and the treatment will last for several weeks or even months. Crystalline powders that are sometimes present with other treatments are absent with IFCO No. 1. Instead of the powder, which is often removed with water thereby starting corrosion all over again, the new preparation leaves grayish spots indicating incomplete treatment of parts of the metal. These are easily treated locally with solvents.

Application of the rust remover is done after wire brushing the metal and cleaning it with solvents. The rust remover is then brushed on or the metal parts are dipped in a tank containing IFCO No. 1.

Industrial Finishes Co, Inc, No. 2 Byrn Mawr Ave, Byrn Mawr, Pa

MORE DATA? Circle 99, inside back cover

Chemicals Produce Olive Drab Finishes on Cadmium Plate

Two powder preparations, one to be used with a solution of nitric acid, called Kenvert No. 11-BE, and one to be used with water, called Kenvert No 11 X, will produce an olive drab finish on cadmium plate. Kenvert No 11-BE solutions used at room temperature will produce a hard wet film on cadmium plate. Color is said to be constant and is also said to be a close match for Color 34087, Federal Standard No 595.

Kenvert No 11X also operates at room temperature on zinc die castings as well as zinc and cadmium plate. It produces an olive drab, corrosion-resistant coating that is an excellent base for paint.

Conversion Chemical Corp, 90 E Main St, Rockville, Conn

MORE DATA? Circle 100, inside back cover

Low-Temperature Fluxless Solder Joins Copper To Aluminum

Low-temperature fluxless solder is designed to be used on aluminum and its alloys, and on zinc, tin, magnesium and copper. In addition to adhering to these metals without the use of flux the solder will join dissimilar metals such as copper to aluminum. Said to be strong enough to replace brazing alloys in some applications, the solder reportedly also has good machinability, can be polished and chrome-plated and is an excellent conductor of heat and electricity.

Metals For Industry, Inc, 299 Pavonia Ave, Jersey City 2, NJ

MORE DATA? Circle 101, inside back cover

High Temperature Lubricant Contains Precious Metals

Hi-T-Lube a lubricant for special applications where high temperatures and pressures are encountered, contains gold, silver and other precious metals. Applied in four separate coatings that total less than 0.001 in. it is said to have durability equal to that of the parent metal. The lubricant, which will function in temperatures up to 1200 F, is recommended for high speed machinery that normally requires constant attention to the bearings. With this lubricant replacement is unnecessary for long periods.

General Magnaplate Corp, Belleville, NJ

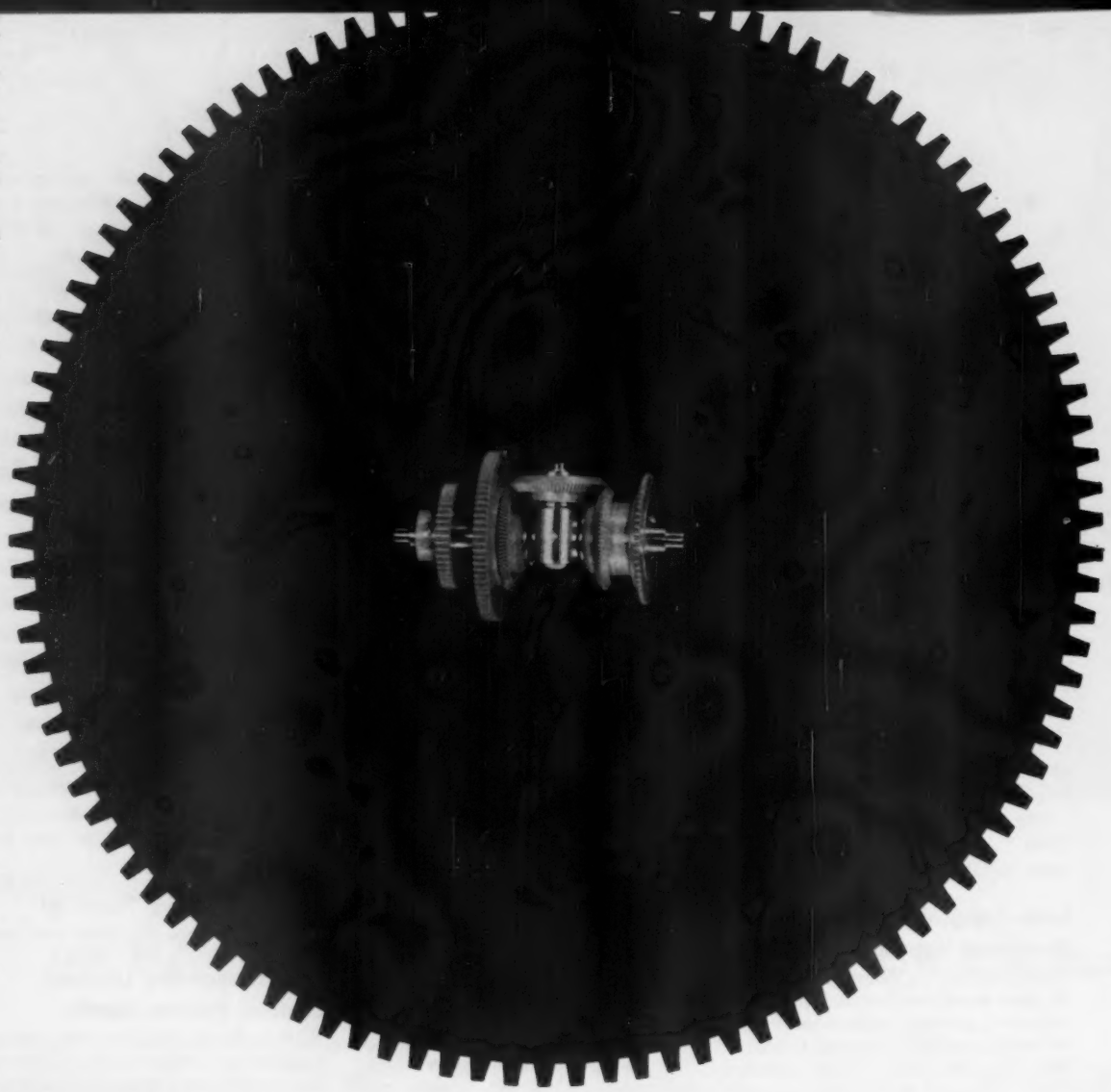
MORE DATA? Circle 102, inside back cover

Sintered Bronze Journal Bearings

Bronze journal bearing with lifetime lubrication is capable of operating in the temperature range of –25 to 200 F. The sintered bronze bearing is available in 13 standard sizes from ¼-in. ID, ¾-in. OD to 20 mm ID, 47 mm OD.

Tann Bearing Co, Div Tann Corp, 3750 E Outer Dr, Detroit 34, Mich •

MORE DATA? Circle 103, inside back cover



AT ROBERTS PRECISION PARTS, INC.

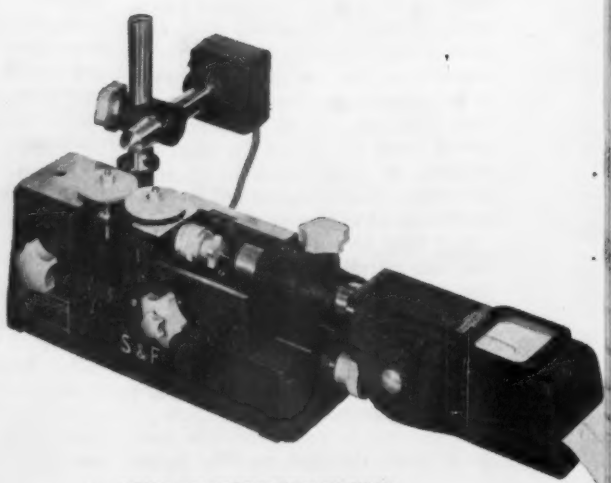
a quality #14 gear isn't considered accurate until an S&F tester proves it

These precise spur gear and bevel gear differentials are destined for important missile and guidance system assignments. Roberts Precision Parts, Inc. makes them as a matter of course in its Woodside, N. Y. plant.

But they don't take manufacturing accuracy for granted. Nor do they trust ordinary gear checking methods. Every gear—whether it be ⅛" or 6", bevel, spur, worm or helical—*must* be cleared during production and final inspection on an S & F Gear Tester to confirm that total composite error does not exceed .00027"; maximum tooth-to-tooth error is within .00014". Robert J. Schmeidel, president, explains it this way: "It would be impossible to check such precision gears properly without our six S & F Testers. As a doctor depends on his stethoscope, we depend on an S & F to show us the defects in any gear."

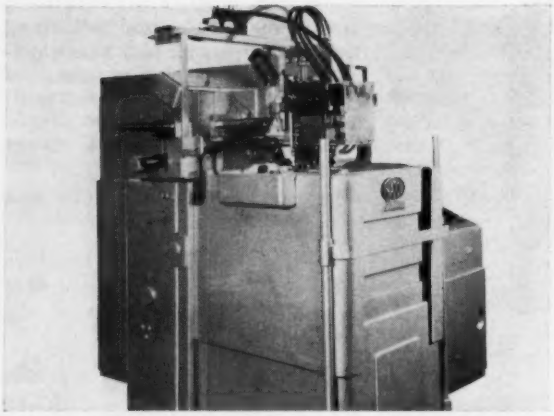
So do hundreds of gear makers—and users—who take precision gear performance seriously enough to check *every* gear by only the most accurate method available—the S & F. (Guaranteed to repeat within .00001".)

Why don't you test the gears you make—or buy—on the S & F? It's the one way you can be sure that they are as accurate as they're supposed to be. Ask us to demonstrate it for you.

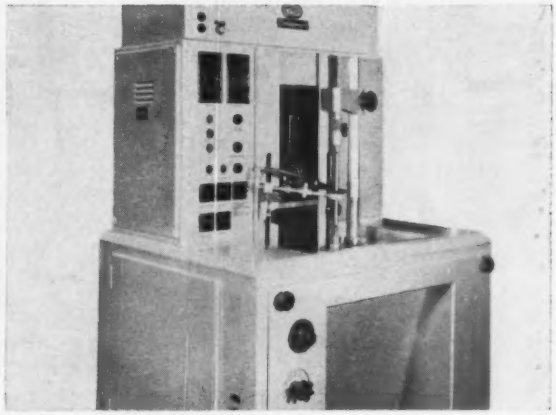


KURT ORBAN
COMPANY, INC.
1259 U. S. Route 46, Parsippany, N. J.

CIRCLE 359 READER SERVICE CARD



Gear tooth hardening machine handles spurs, clusters or helical gears up to 26-in. dia with faces up to 10-in. wide



Universal hardening machines have provisions for index tables; can be built to treat shafts of any length, diameter

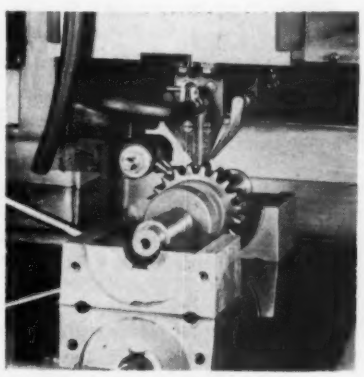
Natco Induction Heat Machines Harden Gears, Shafts, Flats

Outstanding features of the company's induction heating machines are the new oscillator tube equipment and the patented intensifier. The oscillator tube equipment has three principal devices for varying the power under all output conditions while maintaining maximum efficiency. The first is a variable matching transformer arrangement providing fine control over power output. The second is a special matching link connection for single or multi-turn work coils, and the third is a booster condenser that provides additional kva for specific loads.

Oscillator tubes in these units are air cooled and are said to give 6 times longer life. The tube also gives much higher intermittent rating than the equivalent watercooled tube. The oscillator tube generators are available in sizes from 4 kw to 200 kw in either single or double output voltages.

If desired, standard motor generator equipment can be supplied in size from 15 to 300 kw and may be paralleled for higher outputs.

The patented intensifier is shaped to the contour of the work being hardened and, in the case of the gear hardening machine is designed to operate completely submerged in coolant. This method of hardening gear teeth is said to be particularly advantageous because distortion is reduced to a minimum, tooth loading can be increased to over normal, and scaling is eliminated. The process produces a hard wearing surface, yet retains the original tough metal structure of the tooth form, thereby reducing noise levels. The gear tooth hardening machine shown is equipped with a 25 kw RF oscillator tube type generator and control console. The unit may be arranged for either semi or fully automatic operation. Not illustrated but also available from the company are machines for hardening bed ways or other flats. On these machines the intensifier is specially formed to conform to V- or other shapes for continuous hardening.



Closeup of tooth hardening machine shows intensifier shaped to the contour of two adjacent gear teeth. Head traverses along tooth while completely submerged in coolant, giving local heat treatment and immediate quenching

National Automatic Tool Co, Inc, Richmond, Ind

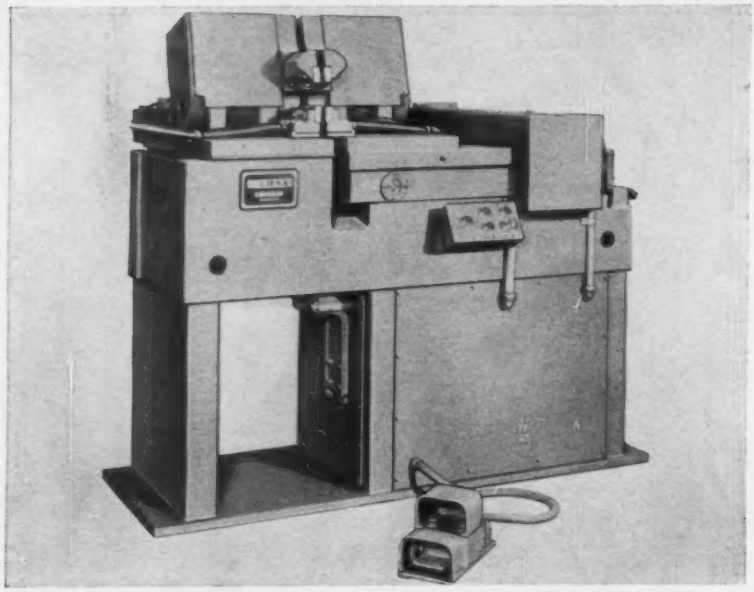
MORE DATA? Circle 51, inside back cover

Transistorized Controls Designed For Automatic Machinery

Line of fully transistorized Sensomatic controls are pulse logic monitoring devices which continuously check and control automatic machine operations. They will stop a machine immediately upon detecting any malfunction. Ruggedly constructed units, with no moving parts, require little power and feature dust-free circuitry encased in epoxy resins.

Model 1200 multi-station detector will monitor machine operations of up to 12 stations. If a malfunction occurs at any one station the machine is instantly stopped and a visual signal alerts the supervisor. The exact location of the trouble is pinpointed and reported by individual indicator lights on the front panel. Prices range from $80 to $850. *Weldotron Corp, 907 Frelinghuysen Ave, Newark 14, NJ*

MORE DATA? Circle 52, inside back cover



Skiaky Flash Butt Welders Give 30,000-lb Clamping Force, 20,000 lb Upset Force

The BPR.0 series of flash butt welders have an upset force up to 20,000 lb and a clamp force up to 30,000 lbs for welding a wide range of industrial metals such as low-carbon steel, stainless, aluminum alloys, and copper.

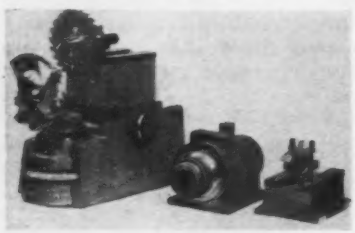
Frame sizes in the series range from 0.01 to 0.04 and the machines are available in 20, 50, 100, and 150 kva at 50% duty cycle. Maximum stock width accommodated is 6 in., maximum stock diameter is 3 in., and minimum ring diameter welded is 5 in. Maximum capacity for the machines in sq in. of cross sectional low-carbon steel is 0.250 in. for the BPR.01 and 2.0 in. for the BPR.04.

Clamps are brought together by foot pedal and the automatic weld sequence is initiated by push button. The flashing and upset actions are both obtained from a single cylinder that drives a contoured hardened steel cam, and this reportedly gives a rapid uninterrupted change between flashing and upset. The flashing speed and upset force may be set independently of each other.

Other features include a roller-bearing mounted platen, direct acting clamps with an air regulator for direct force adjustment; and micrometric vertical adjustment of the right hand platen to compensate for die wear or dies not machined in pairs.

Skiaky Bros, Inc, 4915 67 St, Chicago 38, Ill

MORE DATA? Circle 53, inside back cover



Analyzer Checks Tool Geometry And Location to 0.0001 inch

This new tool analyzer provides a quick accurate method of presetting tools for automated equipment and for checking cutting geometry of taps, drills, end mills, broaches, reamers, and other small tools.

Diameters, depths and tool location can be set to 0.0001 in. accuracies on the analyzer which can be used to check tool geometry at the same time that the tool is being preset.

The measuring principle incorporates a monocular, zero-paralax optical system that allows all readings to be made in one setting. Equipment includes the tool analyser (left) with riser block and v-block; a spindle (interchangeable with v-block and risers) with chuck and collet (center). Equipment on the right is a riser with a v-block showing a cutting tool in position.

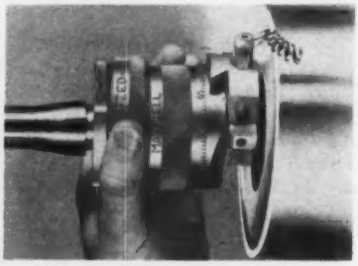
Tool design elements that can be measured with the tool include: hook or rake angles in flutes and spiral points; indexing of cutting edges; concentricity and thickness of web; chamfer angle; relief and length; lead; major and minor diameters; pitch diameter; width of lands and flutes, and included point angles.

Stocker & Yale, Inc, 148 Green St, Marblehead, Mass

MORE DATA? Circle 54, inside back cover

DRILL SPEEDER MODEL 125 has a ratio of 6.25:1 and capacity from No. 80-⅛ in. It can be used in manual, semi, or completely automated operations on all types of drilling machines. Recommended spindle speeds of from 1200 to 3200 rpm will produce maximum drilling speeds up to 20,000 rpm—*Tapmatic Corp, 845 W 16th St, Costa Mesa, Calif*

MORE DATA? Circle 55, inside back cover



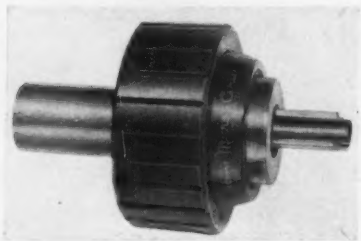
Boring, Facing, Grooving Tool Has Vernier Adjustment to Tenths

E-Z Set boring, facing, grooving tool allows adjustment by vernier to 0.0001 in. The tool, which need not be locked during finish-boring cuts has a leadscrew and nut arrangement that is said to hold the tool tightly without creep so that full accuracy of

adjustment is maintained. In addition to boring and facing, and the tool can be used for counterboring, back counterboring, OD turning, chamfering, and ID and OD grooving. It is available in three sizes; the two smaller sizes give 0.0025 ipr facing feed and 0.100 rapid return. The largest has 0.005 ipr feed and 0.200 return. Feed and rapid traverse are accomplished without stopping or reversing the spindle on all models. A positive stop and an overload clutch have been provided and once the positive stop is positioned and locked, the tool will repeat diameters precisely.

Maxwell Industries, Inc, Ashtabula, Ohio

MORE DATA? Circle 56, inside back cover



ID Chucks Have 0.0002-in. TIR Repeatability Accuracy

Micro-Grip line, repeatability accuracy of which is guaranteed, features interchangeable jaws, shoulder stop, and hardened and ground tool steel construction throughout. They normally have three expanding jaws, but six-jaw construction is available. The chuck is designed to be attached to a machine tool by means of a collet, chuck, or faceplate; it can also be used as a mandrel and held between centers.

Five sizes are available covering a complete range of IDs from ⅜ to 3½ in. by means of interchangeable jaws. Special models can pe provided with threaded jaws, extra long jaws, or multiple diameter jaws. Shoulder stop (furnished as an extra) can be machined to position the work at an exact location on the chuck arbor. Expansion range per set of jaws is 1/64 in. for smaller sizes and 1/32 and 1/16 in. for larger sizes.

LeCount Tool Works Inc, PO Box 252, Cheshire, Conn

MORE DATA? Circle 57, inside back cover

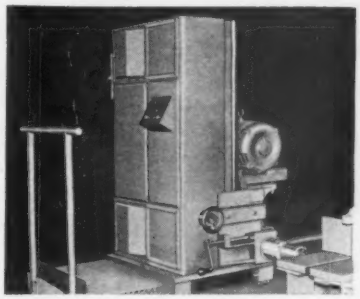
Unit Wraps Cylindrical Objects At Rate of 3000 per Hour

Cylindrical products ranging in diameter from 3/16 to 11/16 in. and in length from ½ to 1¾ in. are automatically wrapped with pressure-sensitive tape in the new Model A automatic tape-wrapping machine. Design of the feed and discharge sections permits handling of products such as tubular capacitors having axial lead-wires. Units are hand-fed and discharge automatically.

Micrometer gages supplied with the machine provide for rapid adjustment to handle various sizes of products. Operating speed is adjustable while the unit is running, with a maximum rate of 3000 pieces per hour. Higher speeds can be provided for automatic-feed applications. The machine is 16 in. wide by 30 in. long by 36 in. high. Drive is by ¼-hp motor for operation on 115 v ac. Price is $3100.

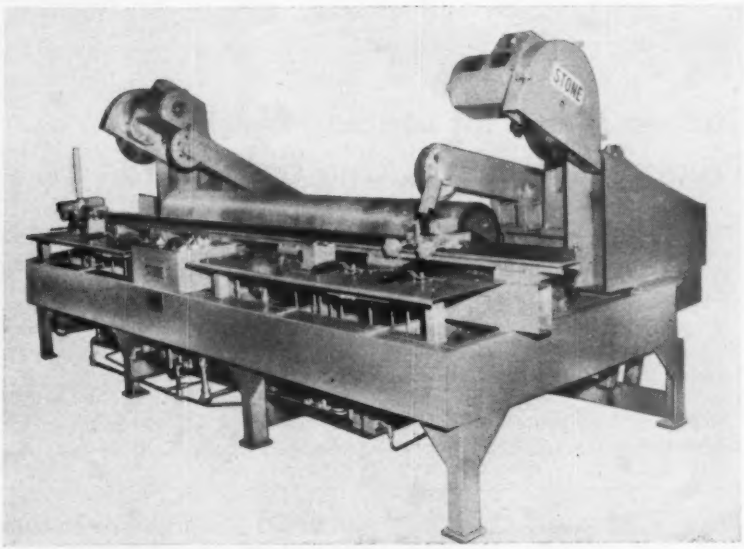
Anderson & Hedquist Machine & Tool Co, 1075 N Tenth St, San Jose 12, Calif

MORE DATA? Circle 58, inside back cover



COMPACT MILLING MACHINE for milling columns, chords, and other structural steel shapes weighs 4000 lbs and stands 72 in. high. 15-hp spindle has 42 in. vertical travel, 66 in. horizontal travel and 3 in. micrometer hand wheel infeed. Complete unit sells for under $13,000—*Futurmill, Inc, 19720 W Eight Mile Rd, Southfield, Mich*

MORE DATA? Circle 59, inside back cover



Stone Pipe Cutting Machine Trims 4⅝-in. Nickel-Chrome Alloy Pipe in 25 Seconds

Developed to trim 11-ft lengths of nickel-chrome-alloy cast steel pipe from 4⅝ to 12¾ in. dia this rotary pipe cutting machine will trim a variety of pipe and bar stock to size.

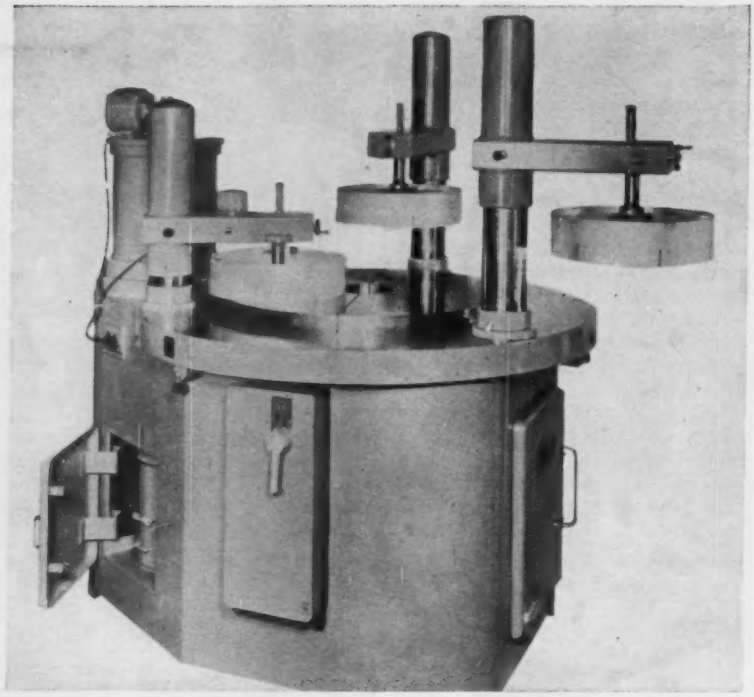
Powered by a 10-hp geared-in-head motor the machine uses 16-in. SNS 245 abrasive wheels to cut 4⅝ nickel chrome alloy in 25 seconds, 8⅜-in. OD cast iron pipe in 32 seconds, and 8¾-in. steel tube in 1 minute.

A centrally located panel gives the operator complete electric and hydraulic control over the cutting heads, rate of feed, elevation, depth of cut speed and direction of rotation.

For cutting, the stock is held in opposing banks of self-centering hard-rubber-faced support wheels spaced the entire length of the machine, and also by pressure rollers near each cutting head. A spring-loaded kerf follower located directly under the cutting wheel also contributes to the accuracy of the cut.

Stone Machinery Co, Inc, Manlius, NY

MORE DATA? Circle 60, inside back cover



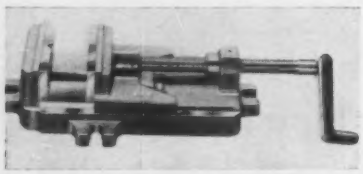
Spitfire 36-in. Flat Lapping Machine Produces Flatness of One Light Band

Designed for large volume production this 36-in. flat lapping machine has a capacity to obtain flatness to 1 light band (0.0000116-in.).

A new dry fluid drive prevents shocks to part and the machine incorporates a three-point bearing contact for the workholder conditioning ring. This contact means that the rings revolve freely on the lapping plate and maintain plate flatness while the parts are being lapped. Operation of the machine is automatic and it can work with a variety of materials including steel, cast iron, bronze carbides, quartz and ceramics.

Spitfire Tool and Machine Co, 2931 N Pulaski Rd, Chicago 1, Ill

MORE DATA? Circle 61, inside back cover



Drillpress, Milling Machine Vises Improved By Columbia

An improved line of drillpress and milling machine vises are said to eliminate the need for special and expensive jig fixtures. Available in 4 sizes, the vises have a vertical slot for holding rounds and base slots that extend toward the front jaw to prevent damage from vertical drilling. The vise bed is designed to clear the heads of mounting bolts, and four 11/16 in. keyslots are spaced at right angles to assure precision location on a press or machine.

Vises have jaw widths of 3½ and 5 in., depths of 1⅞ and 2 in., and openings of 3¾, 4½, 6, and 6⅞ in.

Columbian Vise & Mfg Co, Cleveland 4, Ohio

MORE DATA? Circle 62, inside back cover

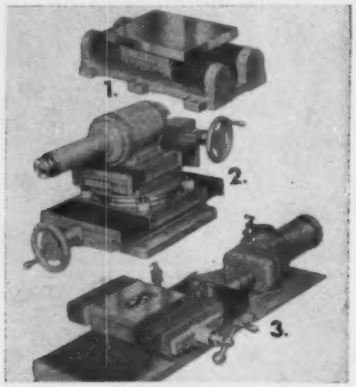
Miniature 4-Flute Reamers Added To Atrax Solid Carbide Line

Called Micro Reamers, these tools are available in Series 9164 (eight fractional sizes from 1/64 through ⅛ in. in diameter), and in Series 9158 (decimal sizes ranging from 0.0151 through 0.115. Precision ground, they have reamer diameter tolerances of +0.0001 to +0.0003.

Recommended for all materials including steels up to Rh 56C, these tools have been application-tested on abrasive plastics, synthetics, fibers, and exotic alloys. They can also be used for close tolerance reaming on electronics circuit board and instrumentation production.

Atrax Co, Newington, Conn

MORE DATA? Circle 63, inside back cover



Standard Units Designed to Adapt Or Convert Machine Tools

For converting an existing machine to a new operation or for incorporation in a completely new machine, the user selects a feed, a compound feed, a swivel and/or spindle as required by the operation. The various units are engineered for bolt-together combination with each other and convenient mounting on a wide range of tools. Units illustrated are typical of many available.

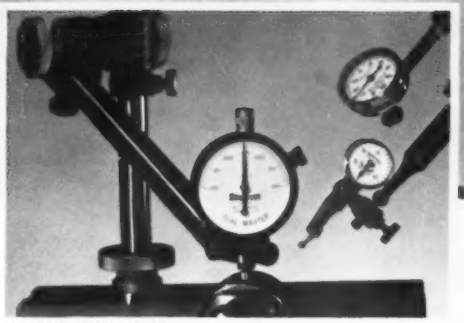
Fig. 1 is an example of a simple unit. This is one type of ball bushing slide shown with hand movement but available with power feed and with or without accordion-type way protectors. Fig. 2 is a more complex assembly combining a 3-hp, 3600-rpm super precision motorized spindle; feed parallel to the spindle with a right-angle micrometer handwheel; 360° graduated swivel base and heavy-duty feed base. Fig. 3 is a compound table or feed base for carrying electrolytic grinding spindles. The illustration shows a table with 18-in. longitudinal power travel provided by a variable speed (0 to 220 rpm) motorized transmission drive. Up to 50 in. of travel is available in standard units. Micrometer dial crossfeed is also available.

Standard Electrical Tool Co, 2480 W Sixth St, Cincinnati 4, Ohio

MORE DATA? Circle 64, inside back cover

CIRCLE 360 READER SERVICE CARD ►

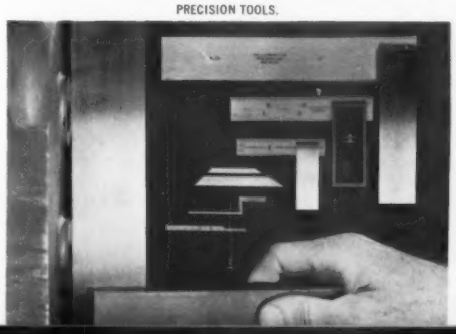
PRECISION GROUND DIE AND FLAT STOCK — Starrett No. 496 Oil Hardening, No. 497 Air Hardening and No. 498 Low Carbon Flat Stock.



DIAL INDICATORS AND GAGES

HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

PRECISION TOOLS.



every inch identified as Starrett® quality and precision

There's no mistaking the quality and precision of Starrett flat stock and die stock . . . each piece is made to exacting Starrett metalurgical specifications and precision ground to Starrett standards of dimensional accuracy.

And there's no mistaking the *type* of steel because each piece is clearly identified by *color* and *name* over the full length. Available in a wide range of sizes in air, oil and water hardening tool and die steel types and in free machining-low carbon flat stock. Individually packaged in distinctive, rust-inhibiting, protective envelopes.

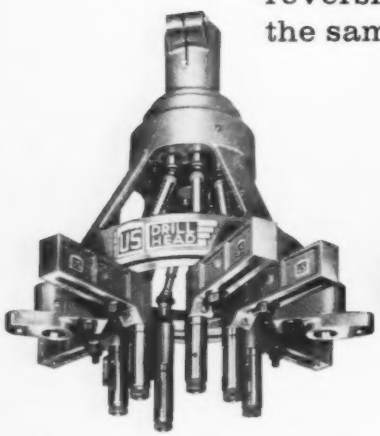
Your nearby Industrial Supply Distributor is your best source for prompt delivery, dependable service and quality products. Call him or write for Catalog No. 27 showing the complete Starrett line. The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

World's Greatest Toolmakers

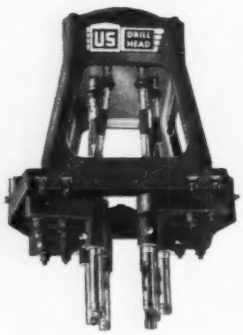
Quick-change deal...

or production runs... drilling only or drilling and tapping*... you can't beat the profit-making performance designed and built into universal adjustable **U.S. DRILL HEADS**

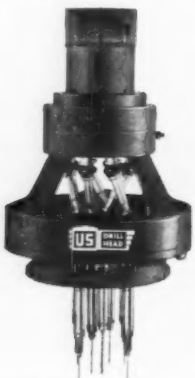
*When your drilling machine has a reversing spindle, you can drill and tap the same hole pattern with one head



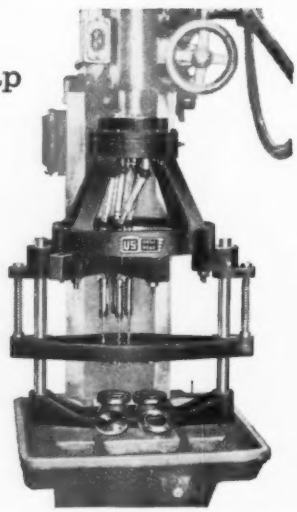
Style U Heads are built in 8 standard models — positive all-gear drive with shaved gears, anti-friction bearings, and neoprene covered, lubricated quick-change joints—smooth, quiet, accurate.



Special head designs for single-purpose machines afford the flexibility of U. S. Drill Head's universal drives.



Slip Spindle Plates, used in place of the adjustable brackets, may be jig-bored to drill more than one pattern of holes.



Holding fixtures with guide bushing plates may be used for drilling two different workpieces at the same time, or to accommodate different hole patterns with a minimum of fixtures and setups. Guide bars maintain alignment.

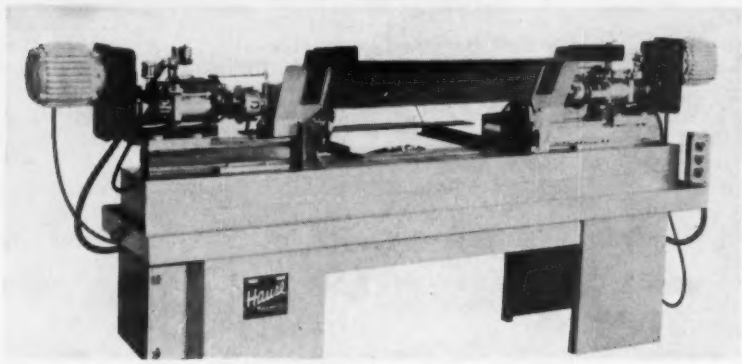
US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

5298 RIVER ROAD • CINCINNATI 33, OHIO

Ask for Catalog AD-57, or send specifications of your requirements.



Hause Threadrolling Machine Threads Both Ends of Metal Rods at Rate of 3000 Rods/hr

Size A Holomatic double end thread-rolling machine automatically rolls threads on both ends of steel, aluminum, and brass rods at the rate of up to 3000 parts per hour. Threads from 6- 40 to ⅞ -9 up to 4 in. long can be rolled on rods from 5 to 76 in. long.

The operator places rods in magazine storage arms and the machine then automatically escapes, locates, clamps, threadrolls, unclamps and ejects the parts in proper sequence. Air powered, hydraulically fed Holomatic units with electric motor-driven spindles are used to power self-opening, end-feed type, thread-rolling heads.

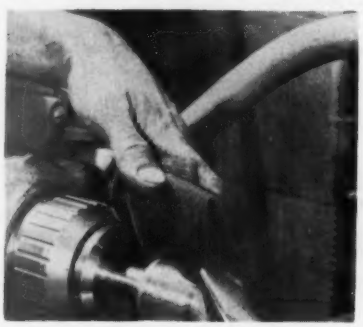
Quick setups for different size rods are made by moving one or both of the independent fixture feed unit assemblies along a full length keyway and fixture jaws can be interchanged for various rod diameters.

If desired, the machine can be run single-cycle with manual clamp and unclamp of the part and manual independent cycle of each power feed unit for setup purposes. Interlock limit switches on the fixtures allow the machine to operate when parts are in the magazine and the moving jaws are in full clamp position. They will stop the machine when the magazine is empty or when a part is improperly positioned.

With a change in tooling the machine, which has spindle speeds from 300 to 3600 rpm, can be used for drilling, centering, chamfering and facing.

Hause Machines Inc, Montpelier, Ohio

MORE DATA- Circle 68, inside back cover



3M Nylon Web Pads Remove Rust, Burrs, Scratches; Blend Welds

Nylon web pads with abrasive impregnated in them make for quick, easy removal of rust, burrs and scratches from all types of metal. The pads are available in two grades; general purpose and ultra fine. Both measure 9½ by 6¼ in. and are ¼-in. thick. The pads, which will not splinter, shread, or rust can also be used for blending welds.

Minnesota Mining & Mfg, Co, St Paul, Minn

MORE DATA? Circle 69, inside back cover

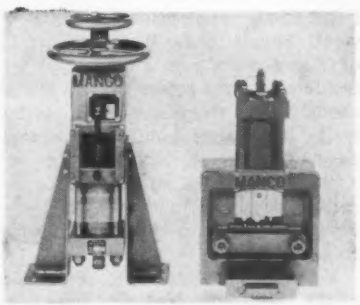
New Thor Air Screwdriver Operates at up to 4500 rpm

The Straight-8 incorporates a Thor QT silencer and twin-clutch torque control for driving small screws and nuts up to Size 8 threaded fasteners. The assembly line tool is built with a new No. 101 Series (Thor-Nado) air motor featuring a five-blade power booster, with a two-blade air trap, for sustained power under load. Available in four speeds, 500, 1000, 2200, and 4500 rpm, the unit is offered with a choice of the company's Sure-Shot Fastener Finder for slotted-head screws, or Zip Chuck for interchangeable use of Phillips type bits, magnetic bits, or socket drivers.

The series is available with instant power reverse or in non-reversible models. Both types are furnished in all speeds and chuck styles. Built-in Air-Gard regulator for pressure and speed control is standard on both models.

Thor Power Tool Co, 175 N State St, Aurora, Ill

MORE DATA? Circle 70, inside back cover



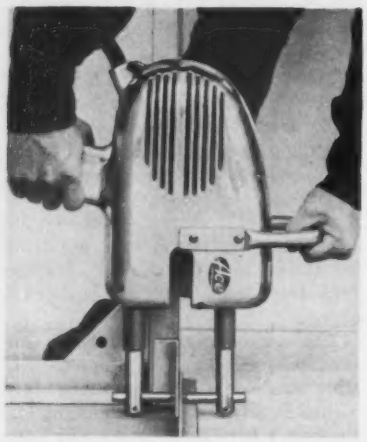
Hydraulic Equipment Tests Mild Steel for Cold Heading

Small shear, one of two companion units designed for bench mounting, cuts the metal into slugs of proper length in proportion to the diameter. Cutting time is 1½ seconds. Diameters from 3/16 to ¾ in. can be handled in the 3-place die and blade. Die and blade sets can be provided for any desired diameter or combination of diameters within the 3/16 to ¾-in. range. Die and blade change in the shear can be made in about 3 minutes.

Slugs cut by the shear are placed in the upset tester. Hydraulically operated ram performs the test in an enclosed chamber in the upper body of the unit. Complete test cycle takes about 2½ seconds. Any percentage of upset desired may be obtained through an adjusting wheel and there is a scale indicator graduated in 32nds. Both units are powered by a single electric motor-driven pump delivering 3 gpm and providing 35-ton thrust.

Manco Mfg Co, Bradley, Ill

MORE DATA? Circle 71, inside back cover



Portable Resistance Spot Welder Has Built-In Electronic Timer

Capacity of this unit is 3/16 in. for cold rolled steel and up to ⅛-in. combined thickness for stainless, galvanized, and cadmium plated steel. Sheets, rods, bars, and studs of many sizes and shapes can be welded. In light production, as many as 200 to 300 welds per hour can be made, depending upon the type and gage of material. The unit can be used in any position from floor to ceiling. A tripod stand or Roto-Holder is available if portability isn't required.

Features include the electronic timer with adjustments from 1/60 second to a full second; 100-amp contactor; independently suspended and completely insulated transformer; rugged construction that permits 1000-lb pressure at tips of electrodes; and up to 3-in. tip opening with 7-in. throat depth. Transformer is heavy-duty, twin-type and air-cooled with a secondary rating of 2 v and 8200-amp short circuit.

Ace-Sycamore Inc, Sycamore, Ill

MORE DATA? Circle 72, inside back cover

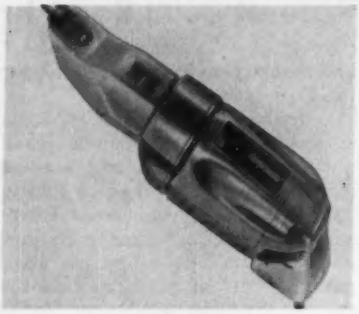
Coolant Supply Units Available From B&S

Two tank and pump units for supplying coolant to machine tools have tanks of 16 and 32-gal capacity with two baffles to aid in settling chips and sludge. Welded steel body and cover provides rigid assembly. These units can also be furnished with swivel casters or welded steel legs.

Tanks are equipped with the ⅛-hp B&S Midget Hi-Flo centrifugal pump which circulates a flow of water soluble coolant or cutting oil up to 300 ssu viscosity. Volumes of 20 gpm at 7-ft head or 10 gpm at 14-ft head are available. Pump motors are furnished for standard electric current ratings.

Brown & Sharpe Mfg Co, Pump Group, Providence 1, RI

MORE DATA? Circle 73, inside back cover

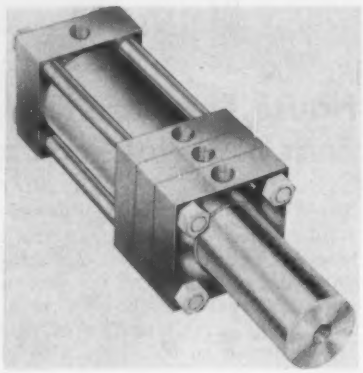


Electric Power Shear Cuts Up to 18-Gage Mild Steel

New Burke-Docken power shear for cutting sheet metal, coils, plastics, fiberglas, formica, aluminum, brass, and copper, weighs 4½ lb, plugs into any 110v outlet. Tool steel side and cutting blades are housed in an aluminum cast shear head. The electric model is priced at $69.50. Air-driven models are also available.

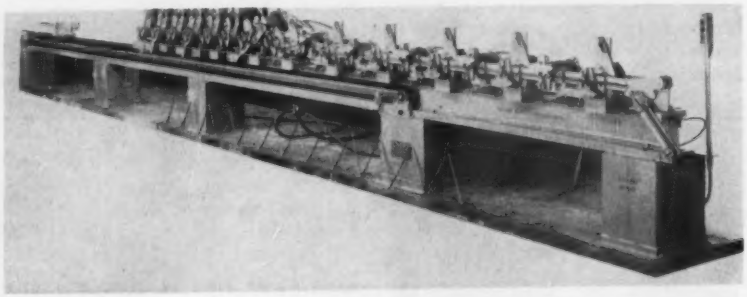
W P B Industrial Products Inc, 8244 Christiana Ave, Skokie, Ill

MORE DATA? Circle 74, inside back cover



POWER-LOK BOOSTERS permit high-pressure hydraulic operation with ordinary shop air pressures. Two series, BA and BD, with capacities of 150-psi (air or oil) to 5000-psi hydraulic are available. Bore sizes range from 1½ to 14 in.—*Milwaukee Cylinder Co, Cudahy, Wis*

MORE DATA? Circle 75, inside back cover



National Bending Machinery Redesigns Web Bender To Increase Output by 25%

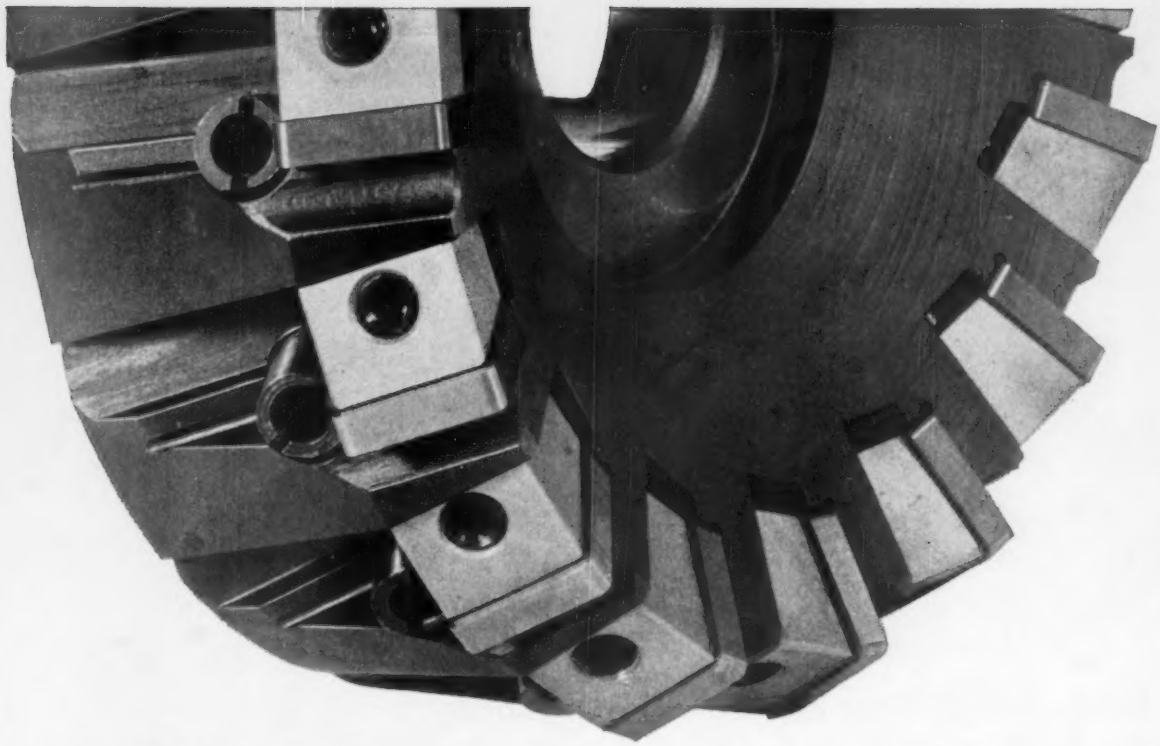
New Zig Zag web bender has redesigned arms and mandrel inserts and roller bearings in place of plain bearings. Result of these design changes is said to be an increase in capacity for making steel webs by over 25 percent. The machine, which bends a steel rod into the form of a web, ejects the web section, and readies itself for reloading, can produce enough web in an eight hour shift to keep welding lines busy when running at 1000 joists a month.

The new arms and mandrels allow quick changeover from one size rod to another and the roller bearings allow the carriage heads to be moved by hand during changes. In addition, rails that support the carriage head assemblies no longer need greasing.

Mandrel inserts are available for any diameter rod, and any depth and pitch of web may be specified.

National Bending Machinery Corp, 100 Station St, Jhonston, Pa

MORE DATA? Circle 76, inside back cover



Here's the new, broader line of

V-R MILLING CUTTERS

V-R Throw-Away Insert Milling Cutters bring the economies of "throw-aways" to your milling operations — provide lowest cost per edge for all roughing, semi-finishing and finishing cuts on light, medium and heavy duty cast iron, steel and nonferrous metals.

V-R "Rigidcut" Milling Cutters, with inserted blades, are available in two basic cone-type designs — fine pitch for high speed, fast feed milling and coarse pitch for light or medium feed and speed combinations.

V-R "Varicut" Milling Cutters, with inserted blades, give you 4-way interchangeability for plain milling, full side milling, half side milling and staggered tooth milling.

Many exclusive V-R Milling Cutter features combine for outstanding production ability. V-R throw-away inserts and inserted blades are available in a wide choice of quality carbide grades. Catalogs 6103 and 6104 show the complete, new V-R Milling Cutter line. Ask your V-R man or write for your copies today.

VASCOLOY-RAMET CORPORATION
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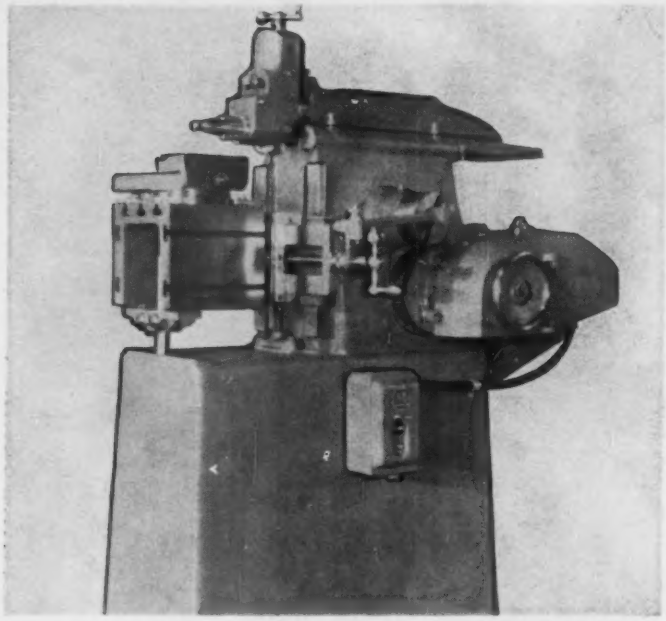
FIRST CHOICE of more and more plants

FM-866



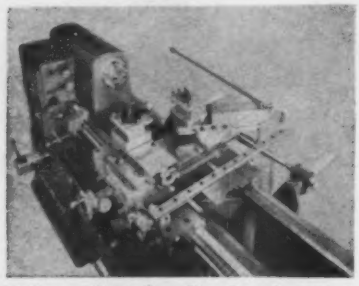
Havir 8-in. Shaper Produces Herringbone Gear Effect on Work For Smoother Finishes

Called the Shape-Rite this 8-inch shaper gives a herringbone gear effect to the finished surface that adds extra smoothness without gear-tooth reproduction on work. The herringbone gear finish is produced because the machine's bull gear and pinion are cut right hand helical angle and the drive gear and pinion are cut left hand helical angle.

Each shaper comes equipped with swivel tables, swivel base vise with steel faced jaws, tool post wrenches, cranks and motor drive arrangements. Bearings are Timken roller on the bull gear with single and double row ball bearings on the gear shafts. The shaper is 44 in. long 24 in. wide and stands 51 in. high.

Havir Mfg Co, 444 N Cleveland Ave, St Paul, Minn

MORE DATA? Circle 77, inside back cover



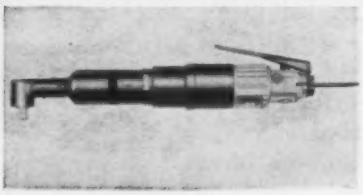
Universal Hydraulic Copying Unit Offered for Cazeneuve Lathes

Unit, available for Cazeneuve HB 500, HB 575, and HB 725 lathes, is designed for both longitudinal and lateral copying. Slideways are chrome-plated to minimize wear and are automatically lubricated during operation. The slide has double guide-ways permitting faceplate work with considerable overhang. A micrometer device allows a finishing cut to be taken immediately after the roughing operation without having to adjust the templet or tools.

The copying unit for the HB 575 and 725 lathes can be provided with a high precision fourway toolpost or special toolholders.

Cazeneuve Lathes Inc, 575 E Linden Ave, Linden, NJ

MORE DATA? Circle 78, inside back cover



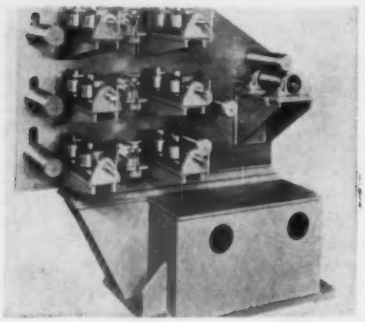
Buckeye Right Angle Tool Has Torque Control Clutch

A fastening tool with a right-angle head and a torque control clutch has been added to Buckeye's 31W series of nutrunners and screwdrivers. Clutch engagement is controlled automatically rather than by the operator's own thrust. Clutch is adjustable for any desired torque from 5 to 100 in.lb. Jaws automatically disengage when the preset torque is reached; re-engagement takes place when the lever throttle is released, momentarily shutting off the tool.

Carrying a rating of ¼ machine screw, the tool is presently available in six models: ¼-in. square drive, ⅝-in. square drive, and ¼-in. female hex at both 500 and 1300 rpm speeds Weight is less than 3½ lb; length is under 12½ in.

Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 79, inside back cover



NARROW-STRIP EDGE CONDITIONER produces burr-free edges on steel strip products by shaving burrs from the strip with special shaving rolls and by rolling the corners of the stock smooth on vertical rolls. Pull-through type (not driven) can be furnished as a separate line for single or multiple strands complete with uncoiler and recoiling equipment—*Steel Equipment Co, 20805 Aurora Rd, Cleveland 22, Ohio*

MORE DATA? Circle 80, inside back cover

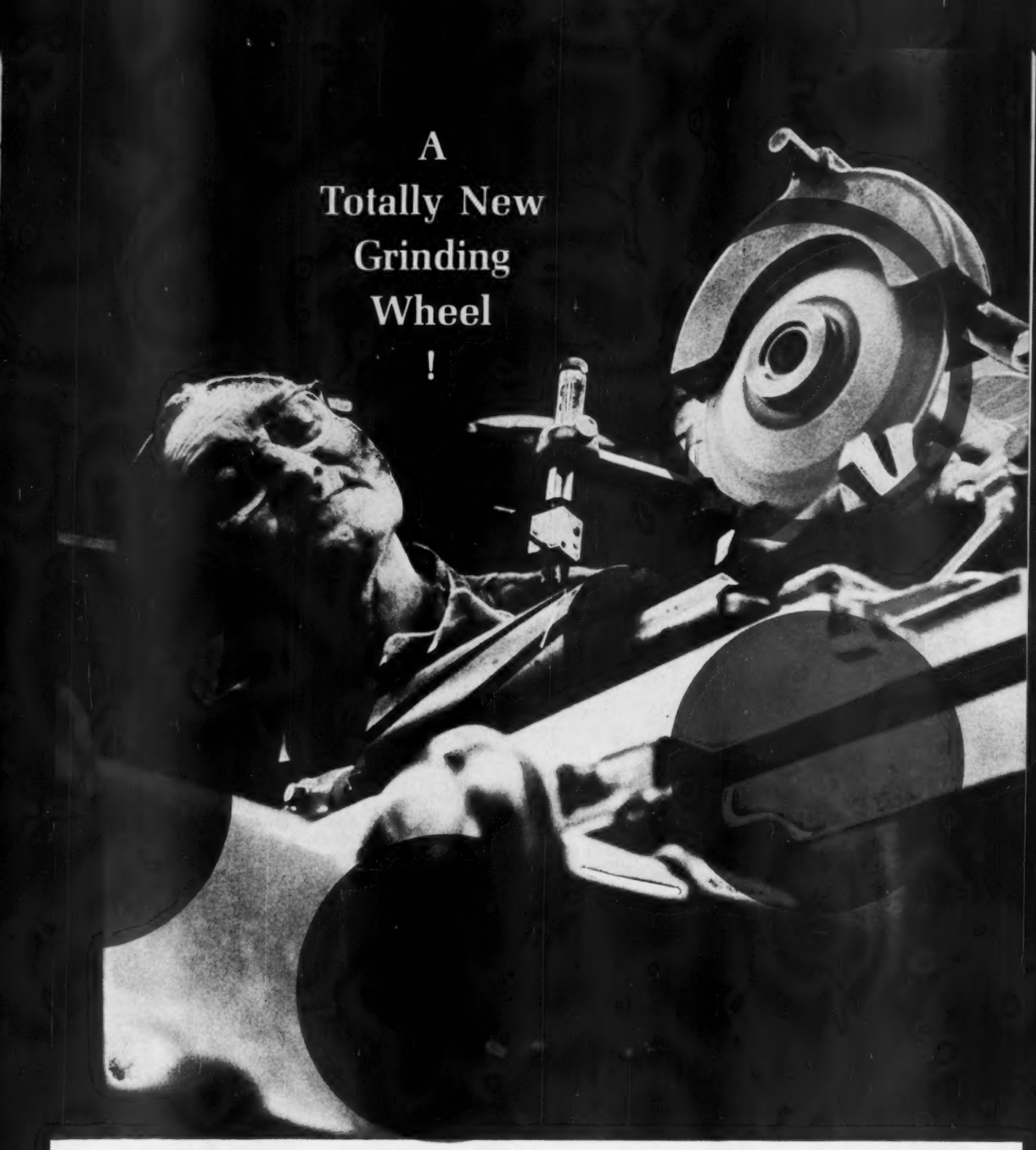
Gear Drive for Plating Barrels Operates in Solutions to 220 F

Seilon gear drives are available in models to fit all barrel equipment, any make, type, size, or age, and are reported to be entirely inert to all solutions (acid, alkali) to 220 F.

Gears are cut in all standard diametral pitches, 20 or 14½° pressure angles. Characteristics include impact and structural strength; resilience; self-lubrication. Chemical properties are non-adsorptive; non-absortive; non-deteriorating; non-contaminating.

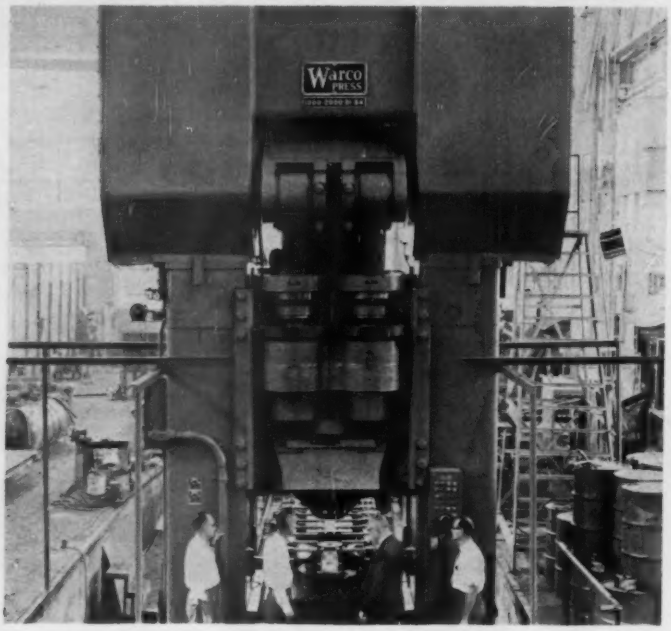
Singleton Co, 11770 Berea Rd, Cleveland, Ohio

MORE DATA? Circle 81, inside back cover



Grind hard tool steels faster—Carborundum's PA-V40 tool room wheel is a totally new grinding wheel built to grind all very hard tool steels—including the new, abrasion-resistant alloys—with superior results. This wheel will surprise you with its performance on severe gashing or gullet type operations in hob and gear grinding, and the grinding of circular form tools. Your operators will be pleased with its extraordinary form holding ability and prolonged resistance to breakdown. *Chances are there is a grinding operation in your shop where Carborundum's new PA-V40 tool room wheel can help you accomplish the job faster and better. If you would like more facts, or to arrange a trial, simply call your Carborundum distributor or factory representative.* Bonded Abrasives Division, The Carborundum Company, Niagara Falls, N.Y. **CARBORUNDUM**

CIRCLE 363 READER SERVICE CARD



Federal-Warco Double-Action Mechanical Press Delivers 3000-ton Total Pressure

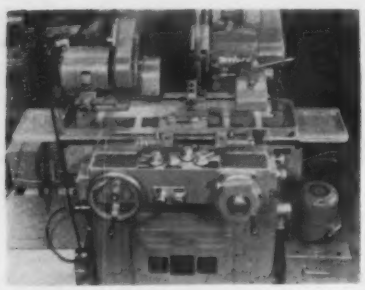
Said to be the largest mechanical double-action press ever built, this huge machine has a four-point outer slide rated at 2000 tons and a single-point inner slide rated at 1,000 tons. The unusual pressure arrangement was designed so that the press could perform sizing and coining operations with the outer slide and cold extrusion with the inner slide, in one operation. The outer slide holds the blank stationary as the inner slide makes contact and extrudes the completed part.

A specially designed bed contains a 20-ton delayed liftout action and a 200-ton pneumatic cushion with provision for hydro-pneumatic delay action. In operation, blanks are hand-fed into a pickup station pocket and from there are fed into a picket in the die. Completed parts are ejected onto a conveyor.

The 650,000-lb unit has overall measurements of 190 by 180 in. and an overall height of 39 ft 4 in. When it is installed it will extend 13 ft 9 in. below floor level. Its blankholder bolster plate measures 54 by 60 in.

Federal-Warco Div, McKay Machine Co, Youngstown 1, Ohio

MORE DATA? Circle 82, inside back cover



Myford Cylindrical Grinder Offered With Hydraulic System

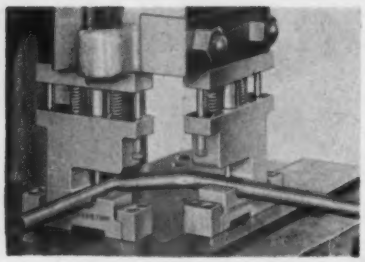
Myford's (English) MG12-H 5 x 12-in. hydraulic cylindrical grinding machine is a high production version of the manually operated MG-12. Both will hold tolerances in millionths. New model is engineered to grind round to 0.00002 in., parallel within 0.00002 in., repeat to 0.00001 in., and finish up to 3 micro-in.

Machine is equipped with a ¼-hp workhead motor up from 1/6 hp. There are 12 work speeds, 6 in the low range from 75 to 390 rpm, and 6 in the high range from 160 to 780 rpm, obtainable through a built-in dc rectifier. There is a tailstock dresser in addition to the table mounted dresser, making it unnecessary to disturb the setup at any time.

Table motion speed range is 0 to 120 ipm. Dwell control variable from 0 to 8 seconds is provided, permitting the table to be stopped automatically at each end of its movement to enable the wheel to grind the entire workpiece. A sufficiently high speed for occasional internal grinding is provide by the maximum table speed. To facilitate such work an optional third stop provides short-stroke table operation at a convenient wheel dressing position. The machine, which is priced at $4350 with standard equipment, is also available at $4690 with optional automatic infeed.

Bentley Industrial Corp, 21-19 46th Ave, Long Island City, NY

MORE DATA? Circle 83, inside back cover



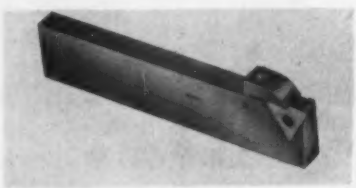
Self-Contained Piercing Units Handle Range of Shapes

Perf-Arcs can be used for piercing holes in straight or curved tubing, also in flat stock, angle iron, and other shapes. They can be used singly or in gangs of two or more. When used in gangs, they can be spaced apart, or at right angles.

Units are furnished in various sizes. Some are for mounting in die sets only; others are for mounting on subplate or directly to bolster plate to function as self-contained units. The bushings and perforators are available in a range of sizes and are interchangeable.

Vogel Tool & Die Corp, 1825 N 32nd Ave, Stone Park, Ill

MORE DATA? Circle 84, inside back cover

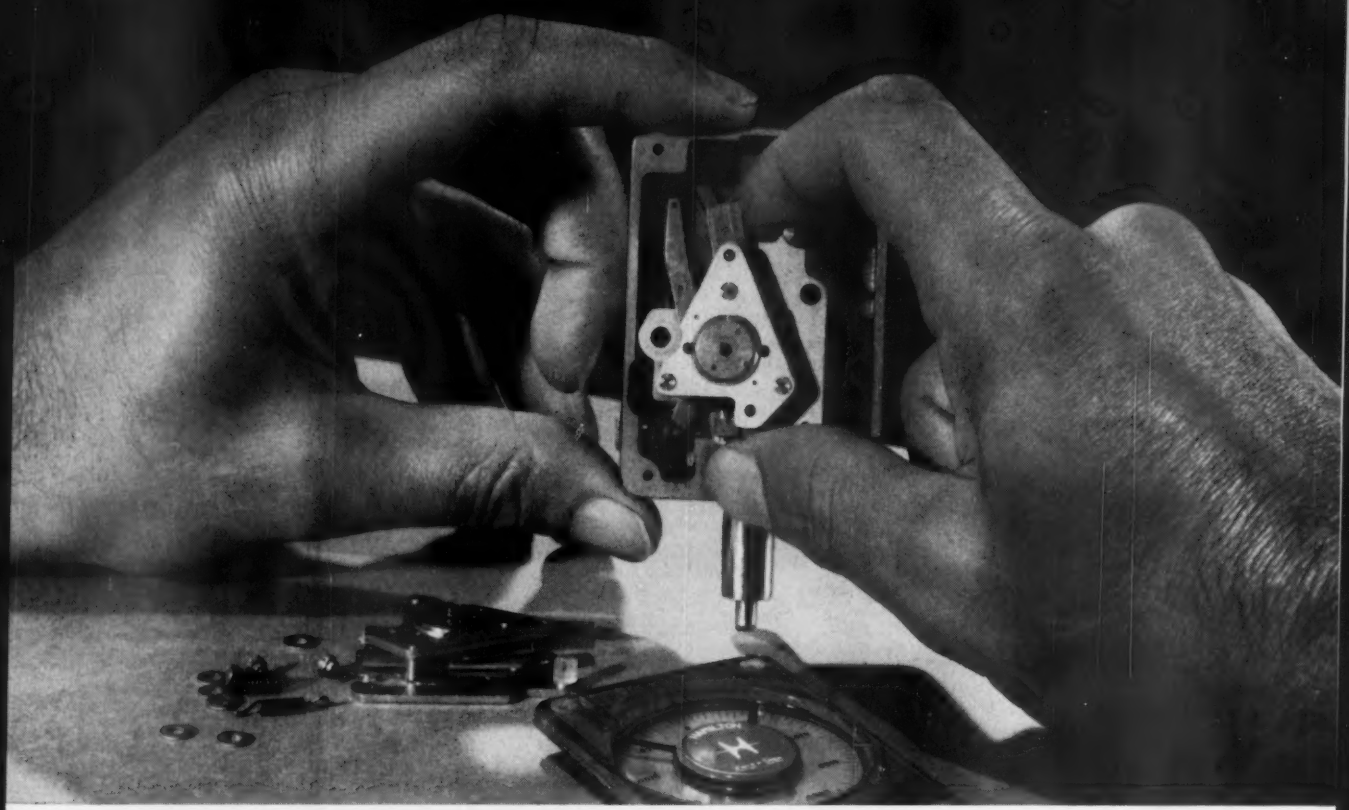


GROOVALL THROW-AWAY TOOLS make it possible to groove near shoulders or machine chucks and face and undercut shoulders. Inserts may be side-mounted for these applications—*US Tool & Cutter Co, 28975 Orchard Lake Rd, Franklin, Mich*

MORE DATA? Circle 85, inside back cover

CIRCLE 364 READER SERVICE CARD ►

2 minute, $10 replacement



Mark up another benefit of Hamilton Gages. For quick, economical maintenance, Hamilton stocks complete movement sub-assemblies. If your Hamilton Gage needs a repair, you "trade in" the old movement and we'll send you a replacement for $10. A few minutes for installation, then you're off and testing. That's it. No inventory of spare parts. Less down-time. Less manpower tie-up.

Let's talk other benefits. Hamilton's gage repeatability to .00001″. Hamilton's light gaging force (2 or 4 ounce) that's adjustable. Hamilton's unique transmission action —*indirect* to gear mechanism—that protects the movement from a heavy force at the spindle end. Hamilton's years of watchmaking experience, so valuable in maintaining the fine accuracy of precision gages. Hamilton's complete line of mechanical and electric gages for post-process inspection or in-process production control.

For free data sheets on Hamilton Gages, write to Dept. 2211, Hamilton Watch Co., Lancaster, Pa. They give full specifications on most items in our line. Or, if you have a special gaging problem, write directly to E. P. Barber, Director of Industrial Products Division.

Kwik-Chek Gages—another precision product of the

HAMILTON WATCH COMPANY

Industrial Products Division, Lancaster, Penna.

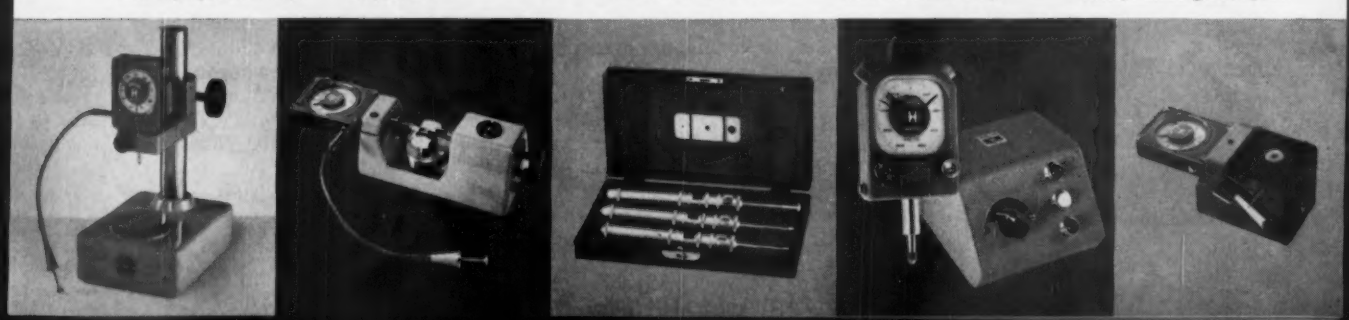
HAMILTON PRECISION DIAL COMPARATOR for applications requiring ultimate in precision. Fine adjustment assures perpendicularity.

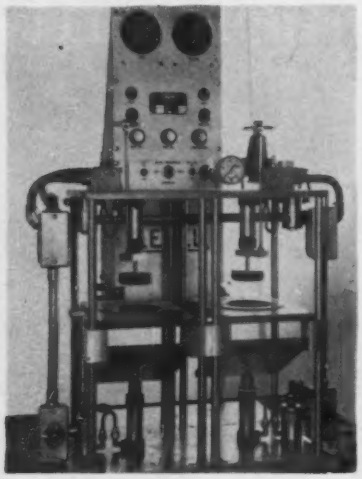
HAMILTON HORIZONTAL JAW GAGE for precise measurement of miniature parts. Stage is completely adjustable.

HAMILTON HOLE GAGES replace as many as 700 plug gages. Precision accuracy in range from .025″ to .380″ . . . increments of .001″.

HAMILTON ELECTRIC GAGING SYSTEMS for in-process control. Lights indicate several out-of-tolerance dimensions simultaneously.

HAMILTON SMALL BORE GAGE for measuring small holes. Custom feelers can be supplied for stepped bores, internal grooves, etc.





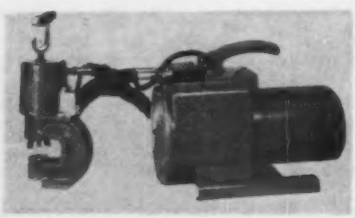
Induction Heating Fixture Is Two-Station Unit

Fixture for brazing, shrink fitting, hardening, and other heat treating operations allows the generator to operate at maximum duty while permitting a minimum of work handling by the operator. After the loading is completed at one station, operator depresses a footswitch which activates the control center that automatically takes over the functions of 1) transferring the high frequency power to the work station requiring heat; 2) timing the heating cycle; 3) timing the holding period for applied pressure or cooling; 4-releasing the completed part.

While one station is being automatically operated, the other is loaded and the control center signalled. Heating will begin at the newly loaded station as soon as the heating action of the work cycle at the first station is completed. It is said that even an unskilled operator can do a fairly complicated job at a high rate of production.

Lepel High Frequency Laboratories Inc, Woodside, NY

MORE DATA? Circle 86, inside back cover



Hydramic Power Unit Designed For Whitney Portable Punches

The 700-T-½ has two-stage pumping system for rapid approach, and slow down for work stroke. New design insures no loss of operating pressure during prolonged punching operations. Control valve design uses reversing motor for change of fluid flow; motor runs only when ram is moving. Heavy-duty contactors control motor direction with use of pushbuttons. Unit weighs approximately 59 lb with oil and is 16-½ in. long.

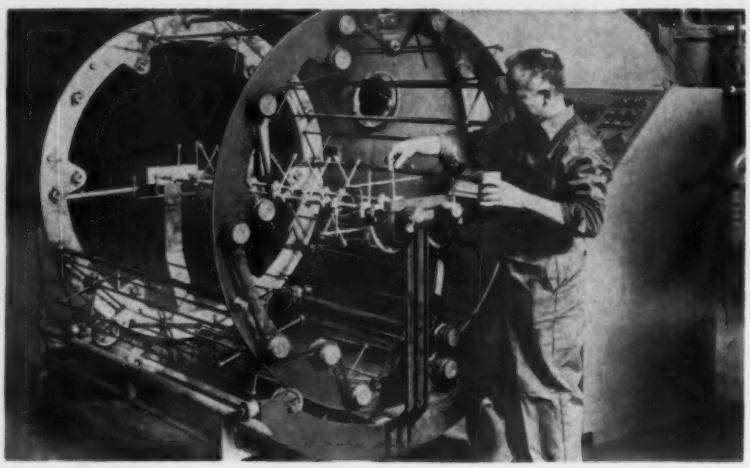
Model can be adapted for use with pressure switches, external adjustable relief valves, and pilot-operated check valves. It can be used with riveting guns, pinch-off tools, and will operate both single and double-acting cylinders and can be installed on existing Whitney portable punch units as a replacement for the previous model 700-S-½.

W A Whitney Mfg Co, 636 Race St, Rockford, Ill

MORE DATA? Circle 87, inside back cover

PINCH POINTER, Hi-Speed 400, with capacity of 400 pieces per min will point screw blanks or any other product requiring needle or diamond points, of any material from a No. 2 size up to a 5/16-in. (0.281 in.) dia screw—*Behr Machinery & Equipment Corp, Rockford, Ill*

MORE DATA? Circle 88, inside back cover



Stokes Metallizer Takes Ten 16-in. Reels, Gives 54-in. Useable Length Per Reel

Newest version of the company's 72-in. vacuum metallizing system, the model 427-6 can now accommodate 10 16-in. diameter reels at once rather than 10 14-in. reels as before. In addition it now gives a full 54 inches of useable length on every reel, which is two inches more than before.

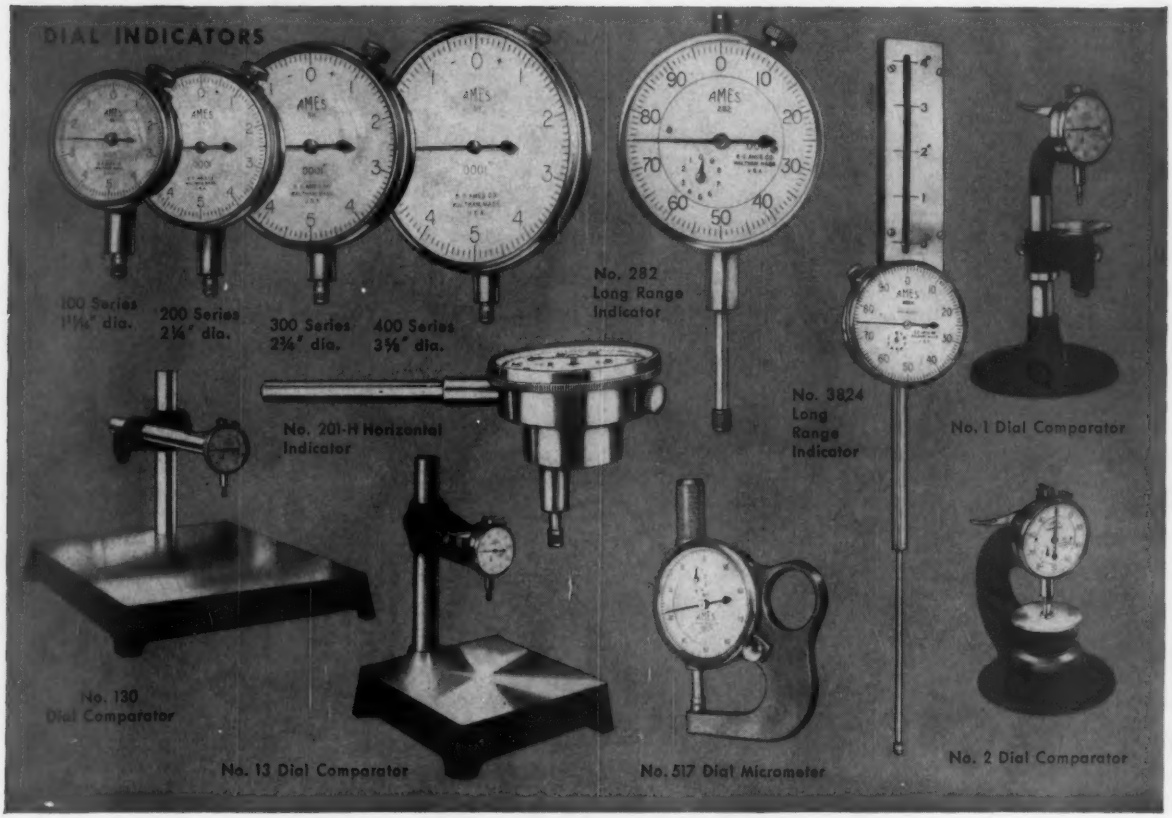
Faster metal evaporation is achieved on the new system with a new power supply of 30 kva capacity, and the pumping system has been redesigned to incorporate a single model 1711 mechanical booster pump to back up the two 16-in. oil diffusion pumps. The new design gives larger gas handling capabilities in the high pressure ranges—for example, over 1000 cfm at 10 mm Hg. This eliminates pressure surges at the moment of firing and gives faster roughing and higher capacity for backing up the diffusion pumps.

Other improvements include a high conductance plenum concept in the diffusion pump manifolding. A large plenum chamber directly to the rear of the metallizing chamber is substituted for the conventional arrangement of two separate exhaust pipes leading out of the chamber. The new concept means less piping and lower headroom needed for the chamber.

F J Stokes Corp, 5500 Tabor Rd, Philadelphia 20, Pa

MORE DATA? Circle 89, inside back cover

AMES *Masters of Measurement*


DIAL INDICATORS
100 Series 1 1/16" dia.
200 Series 2 1/4" dia.
300 Series 2 3/4" dia.
400 Series 3 5/8" dia.
No. 282 Long Range Indicator
No. 201-H Horizontal Indicator
No. 3824 Long Range Indicator
No. 1 Dial Comparator
No. 130 Dial Comparator
No. 13 Dial Comparator
No. 517 Dial Micrometer
No. 2 Dial Comparator

DIAL INDICATORS AND GAUGES

Use Them for Checking: taper, height, depth, flatness, roundness, straightness, thickness, diameter, length and size.

Features Include: easy-to-read dials, unbreakable crystals, forged cases, backs and wheel support, contour-lapped pinion teeth.

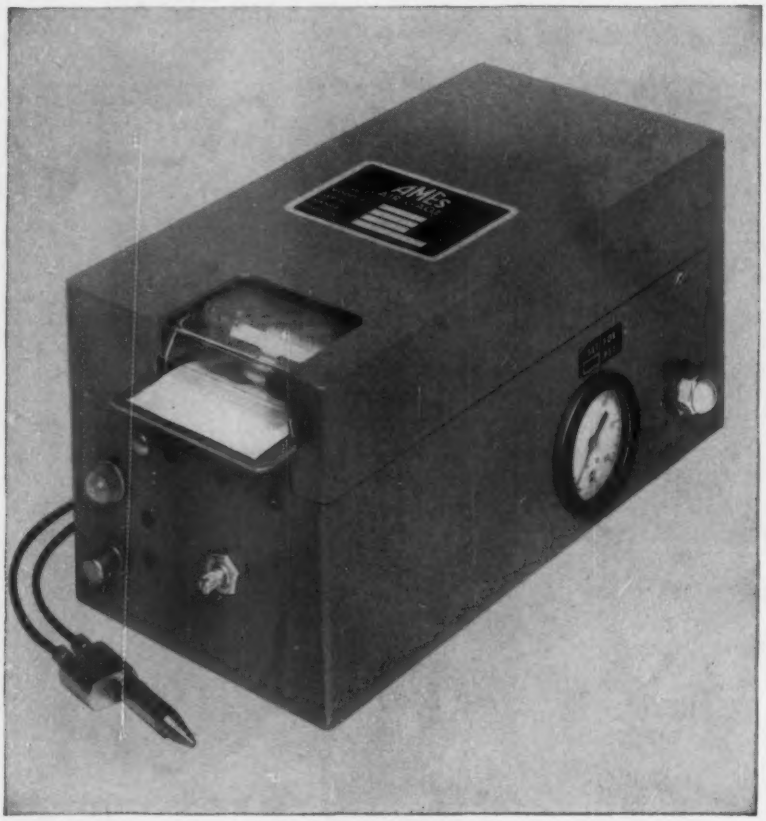
Attachments: rubber and metal dust guards, long stem indicators, tolerance hands, lift levers, special backs, contact points, etc.

For literally hundreds of measuring, indicating and comparing operations, you'll find Ames standard and customized gauges and indicators unerringly accurate and amazingly durable . . . *You're asking for the best when you specify Ames!*
B. C. AMES CO., Waltham 54, Mass. Representatives in Principal Cities—
In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B. C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

AMES *Masters of Measurement*



ACCU-FLOW Air Gaging Equipment

The new line of ACCU-FLOW air gages developed by B.C. Ames includes several patented components, including nozzles and pressure indicators, which give these gages unusual range and exceptional linearity.

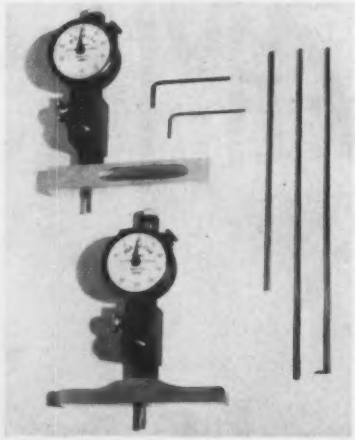
Special Models are Available for Checking: outside and inside diameters, center distances, flatness, roundness, hole depths and continuous non-contact measuring or comparing of paper, metals, plastic films, etc.

Ames ACCU-FLOW Air Gages are providing the answer to many measuring problems that were once considered impossible to solve. For complete information on the entire line of Ames air gaging equipment, write for new ACCU-FLOW folder. *You're asking for the best when you specify Ames!*

B. C. AMES CO., Waltham 54, Mass. Representatives in Principal Cities—In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS



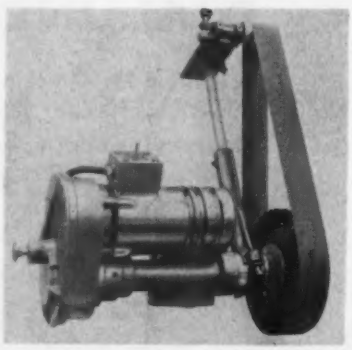
New Gages Added To Boice Line

Reliant Model B-1500 is fully adjustable for a depth range of 0 to 5¾ in. It is said to be more accurate than fixed-shank types for measuring depths of holes, slots, grooves, internal shoulders and recesses. Close tolerances can be checked rapidly without necessity for counting dial revolutions. The gage set includes gage body with 0.0005 in. 0-25-0 dial indicator, one 4¼ in., one 6-in., and two 8-in. rods of 0.125-in. dia. One 8-in. rod is straight; the other has a hardened foot for gaging grooves and recesses.

Reliant Model B-1600 dial indicating depth gage for 0 to 2-in. depth range is also equipped with 0.0005 in. 0-25-0 dial indicator.

Boice Gages Inc, Hyde Park, NY

MORE DATA? Circle 104, inside back cover



Versagrind Does OD Abrasive Belt Or ID Abrasive Sleeve Work

Designed for lathe, planer, or bench mounting, the Versagrind will operate on most basic machines for rough grinding or super finishes. Because of its 60-lb weight, positioning problems are minimized.

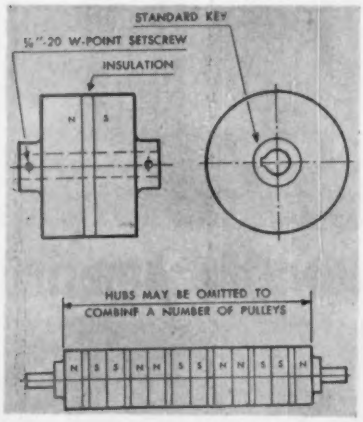
On lathes of 16-in. swing or over,

the unit is mounted in the tool-post T-slot. On lathes smaller than 16-in. swing, the compound should be removed. Idler arm swivels full 360° to allow grinding against the contact wheel or on the slack of the belt for contour grinding. A quill is furnished for ID abrasive sleeve grinding.

Specifications include 2-hp 3-phase continuous-duty motor; 2-speed geared head, 2350 rpm for OD abrasive belt grinding, 4850 rpm for ID abrasive sleeve grinding.

Larmet Co, 108 Wiggs St, PO Box 193, Griffith, Ind

MORE DATA? Circle 105, inside back cover



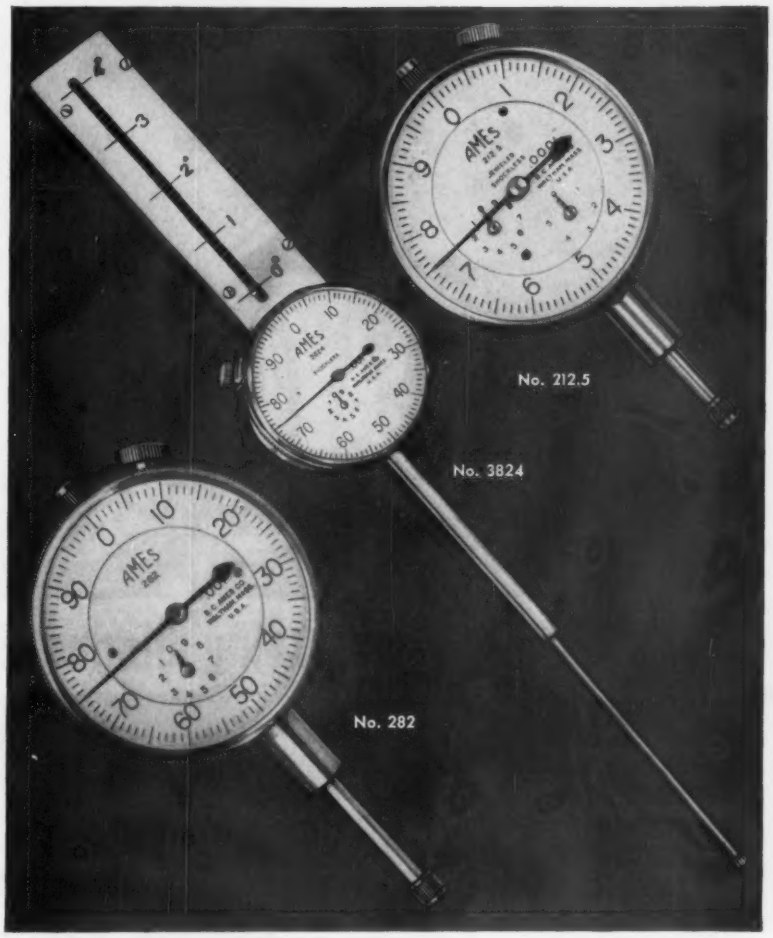
Magnetic Auto-Feed Rolls Speed Ferrous Metal Handling

Homer Permanent Magnetic Auto-Feed Rolls and small-diameter radial-pole magnetic pulleys for transfer of ferrous metal sheets to and from presses, or in cutoff and stacking operations, are suited for use in automated magnetic ferrous material and handling systems.

Where the operation is up, over, down and around in a production flow, the rolls are used to transfer high-center-of-gravity items from magnetic conveyor incline sections to horizontal sections and to magnetic lowering sections. Rolls are also supplied for operations requiring transfer from one conveyor to another to turn the production flow. Single rolls or multiple assemblies may be used on systems operating with or without belts. Rolls have a surface traction of 46 lb with 0.250 gage flat steel sheet when in direct contact with the pulley surface, and up to 19 lb when a 3/16-in. thick smooth surface belt is placed between pulley and steel sheet.

MORE DATA? Circle 106, inside back cover

AMES *Masters of Measurement*



Long Range Dial Indicators

Use Them for Checking: long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel up to 12".

Features Include: large diameter dials, widely spaced dial graduations, movable dials, replaceable contacts and count hands.

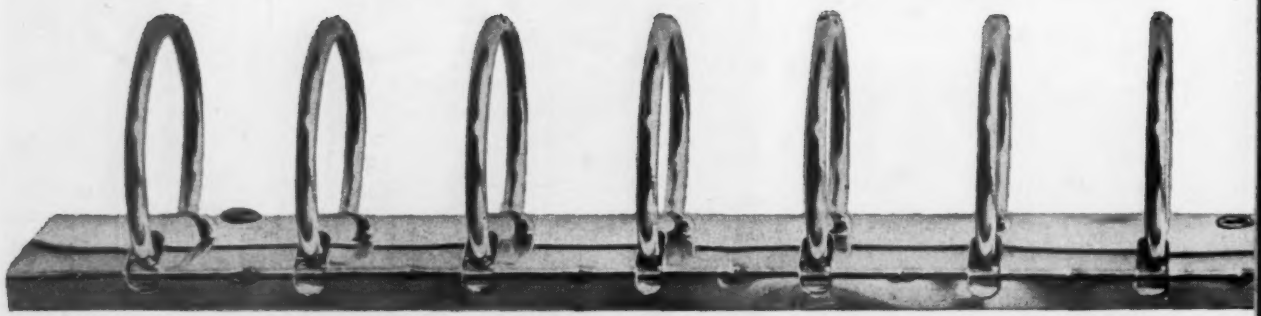
For literally hundreds of measuring, indicating and comparing operations, you'll find Ames standard and customized gauges and indicators unerringly accurate and amazingly durable . . . *You're asking for the best when you specify Ames!*

B. C. AMES CO. Waltham 54, Mass. Representatives in Principal Cities—In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B.C. AMES CO.

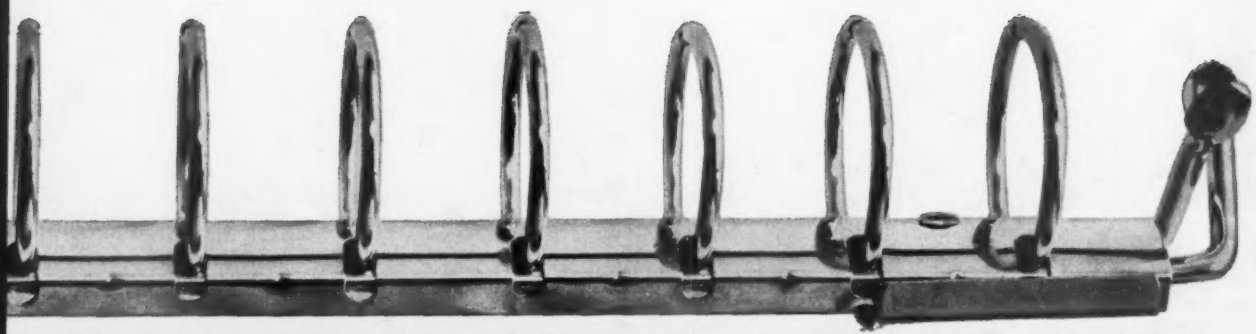
MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

This mark tells you a product is made of modern, dependable Steel.

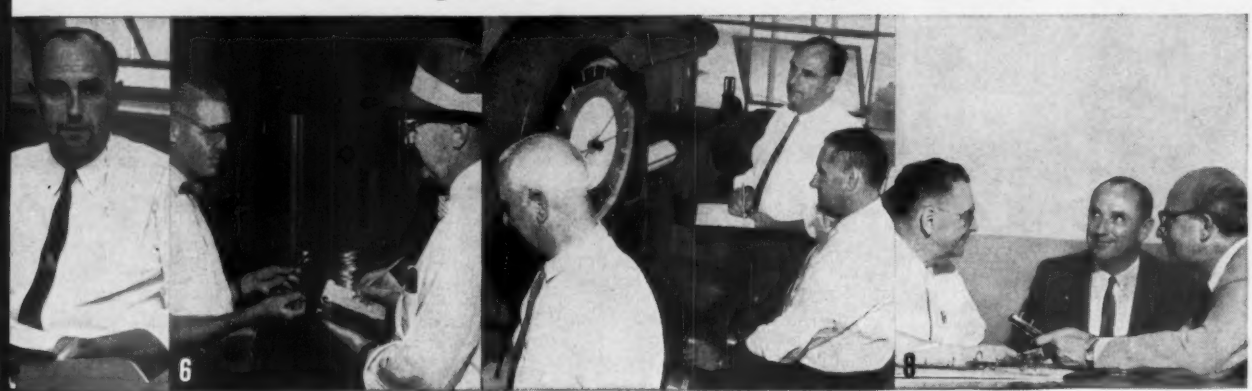


This is a new kind of ring binder. Below: the American

It opens, closes, and locks the rings, preventing spilled sheets. That's about all a ring binder does. And yet, coming up with the right wire for this binder was more than half a job. National Blank Book Company, Holyoke, Mass., asked our sales representative for an assist. He conferred with Charlie Canney—one of our top service metallurgists. **1.** Charlie met the people at National. **2.** He talked to their production people, came up with a profile of the wire they wanted. It had to have a uniform temper, the right temper for making the binder's snap-action ears, a clean, smooth surface for welding and plating, a temper which would vee-notch cleanly and still be rigid enough to stand distortion during production. **3.** Charlie took his problem back to our Worcester plant, talked it out with Clyde Westhaver, general foreman of cleaning, coating, heat treating; and Fred Brierly, product metallurgist. **4.** And then to the Metallograph—an instrument used in one of the many tests that determine the right properties. **5.** Charlie's report followed. **6.** Next, into limited production on the wire.



Steel and Wire specialists who helped make it click.

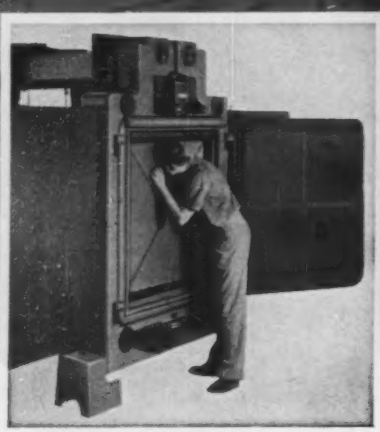


Wilfred Blades, quality control supervisor, and Francis Whalen, works metallurgist, kept close check on its condition during the initial draw. **7.** Before shipment, Arthur Weissinger and John Conrad, lab technicians, took stress-strain recordings **8.** The result: a ring binder that works just fine, and another satisfied customer. Call your American Steel and Wire salesman or nearest sales office the next time *you* need a metallurgical assist, or the best wire you can buy. American Steel and Wire, Rockefeller Building, Cleveland 13, Ohio.

Innovators in Wire

USS TRADEMARK

American Steel and Wire Division of United States Steel



The large magnesium vacuum-plate is precision machined with 80 milled grooves and 80 drilled holes.

MACHINABILITY OF MAGNESIUM TOOLING PLATE

cuts production cost of giant film holders

46-inch-square vacuum film holders of magnesium tooling plate hold film and half-tone screens accurately in place in process cameras made by Robertson Photo-mechanix, Inc., Chicago.

WHY MAGNESIUM TOOLING PLATE? Unsurpassed machinability cuts the time and cost of precision-machining the 80 grooves and 80 holes in the plate . . . as-delivered flatness eliminates the need for surface machining . . . and light weight assures easy handling and accurate positioning of the holder in use.

Lightweight magnesium tooling plate offers these and many other advantages for tooling. It's the lightest of all structural metals, yet it's stiff and rigid. And being the easiest-to-machine metal, it reduces machining time and tool wear. New close thickness tolerances, flatness and high dimensional stability provide lasting accuracy, with minimum warping after machining.

Find out how lightweight, machinable magnesium tooling plate can cut your tooling fabrication and handling costs. Write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1111F11-13.

DOW MAGNESIUM MILL PRODUCTS

THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company

CIRCLE 370 READER SERVICE CARD

DOW

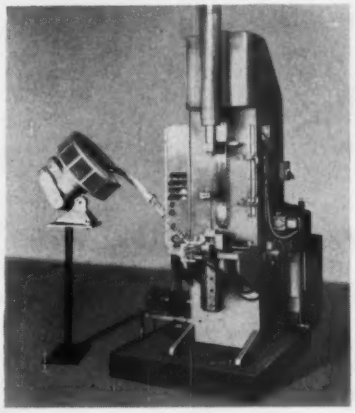
GET FAST DELIVERY OF MAGNESIUM TOOLING PLATE FROM THESE DISTRIBUTORS

Baltimore, Maryland
Clendenin Bros., Inc.
EAstern 7-4500
Charlotte, North Carolina
Hubbell Metals Inc.
EDison 4-5385
Chicago, Illinois
Fullerton Metals Co.
MErrimac 7-2700
Cleveland, Ohio
Copper and Brass Sales, Inc.
VUlcan 3-8100
Dallas, Texas
Joseph T. Ryerson & Son, Inc.
FEderal 1-4311
Detroit, Michigan
Copper and Brass Sales, Inc.
FOrest 6-6200
Grand Rapids, Michigan
Copper and Brass Sales, Inc.
EMpire 1-6681
Hialeah, Florida
Fullerton Metals Co.
TUxedo 8-8424
Indianapolis, Indiana
Hubbell Metals Inc.
STate 7-1341
Kansas City, Missouri
Hubbell Metals Inc.
BAltimore 1-7760
Louisville, Kentucky
Hubbell Metals Inc.
MElrose 7-2595
Los Angeles, California
Reliance Magnesium Company
LUdlow 3-6361
Marietta, Georgia
Hubbell Metals Inc.
427-5551
Memphis, Tennessee
Hubbell Metals Inc.
WHitehall 8-1661
Milwaukee, Wisconsin
Fullerton Metals Co.
HUmboldt 1-6900
Minneapolis, Minnesota
Fullerton Metals Co.
STerling 1-3456
New York (Lyndhurst, New Jersey)
A. R. Purdy Co., Inc.
CHelsea 3-4455
Portland, Oregon
Eagle Metals, Inc. of Oregon
ATlantic 8-5201
St. Louis, Missouri
Hubbell Metals Inc.
FRanklin 1-0212
Seattle, Washington
Eagle Metals Company
PArkway 3-9974
Spokane, Washington
Eagle Metals Company
KEystone 4-0586

THE DOW METAL PRODUCTS COMPANY

DOW MAGNESIUM MILL PRODUCTS

CIRCLE 371 READER SERVICE CARD



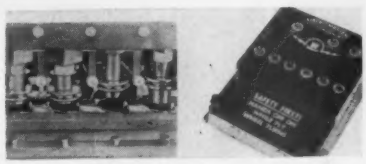
Gear Output Increased 200% by Broaching

According to the manufacturer of the GBP 6-28 standard broaching machine and tooling, broaching of the gear teeth will produce gears at approximately 1000 parts per hour per machine. This rate represents more than a 200% increase over the machining method formerly used. One operator can easily handle several machines of this model.

Set up for automated high-production cycling, 1024 steel gear blanks are loaded, oriented, and conveyed to the broaching fixture along a track from a rotating, gravity-fed hopper. Automatic slide feeds the blanks into broaching position. Parts are then pushed through a pot containing accurately ground and located broaching inserts. In one pass, all nine gear teeth are cut with stock removal of 0.160-in. tooth depth. Machine is engineered for gravity unloading. Concentricity of the gear bore with tooth pitch diameter is held to 0.003 in. TIR. Broaching speed is 50 fpm down —100 fpm up, utilizing a 24-in. stroke. Entire machining cycle is hydraulically actuated

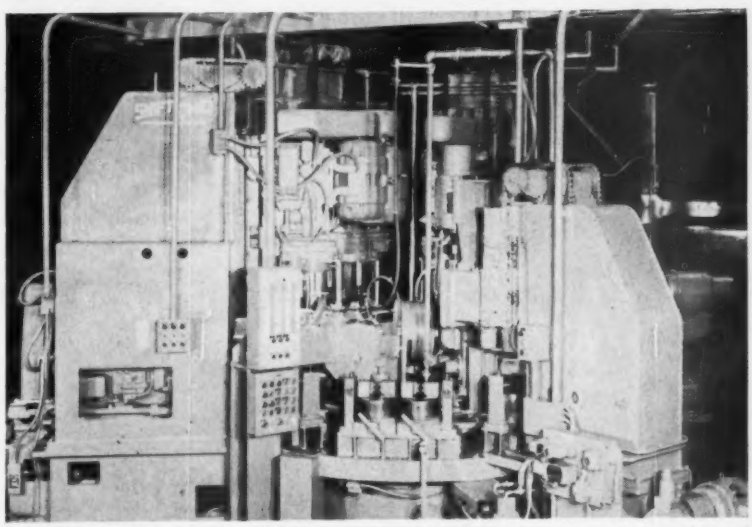
General Broach & Engrg Co, 14333 Prairie Ave, Detroit 38, Mich

MORE DATA? Circle 107, inside back cover



IMPROVED MODEL of the auto-transfer (AM/MM May 15, '61 p229) which shuts down a press when a malfunction occurs at any station, this new Autotransfer also gives a signal light that tells exactly where the trouble is located. Temperature changes, voltage fluctuations, and mechanical changes that may occur as a press warms up have no effect on the functioning of the safeguard—*Wintriss Controls, Div of Industrionics Controls, Inc, 20-24 Vandam St, New York 13, NY*

MORE DATA? Circle 108, inside back cover



AUTOMATIC INDEXING MACHINE drills, chamfers, reams, and taps forged steel L's and T's in nominal pipe sizes ⅜, ½, ¾ and 1 in. Production capacity is 200 per hr of ⅜-in. T's and L's, steel forgings, high-pressure fittings; 300 per hr of 1-in. products, with ±0.005 accuracy of line holes—*Swift Ohio Corp, Kenton, Ohio*

MORE DATA? Circle 109, inside back cover

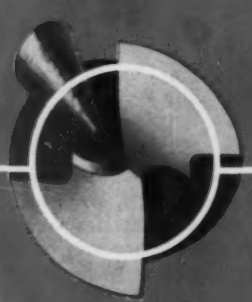
The Only Holes You Can't Drill Quicker . . . Cleaner . . . Cheaper with a SPEEDICUT "CHIPBREAKER"

The SPEEDICUT "CHIPBREAKER" is not for doughnuts. But when it comes to drilling holes in metal (from ⅛" up to 6" in diameter), at the lowest cost-per-hole, there is no drill made that can do the job like a SPEEDICUT "CHIPBREAKER".

The patented rib* makes the big cost-cutting difference. Permits 50% to 400% higher feed rates . . . deep hole drilling without withdrawals . . . no down time for cleaning out packed spinnings and swarf . . . more holes per regrind.

But don't take our word for it. Let your local authorized SPEEDICUT "CHIPBREAKER" distributor prove it with a "no obligation" demonstration in your plant on your own equipment and type of work.

May we send you his name and a descriptive catalog of the SPEEDICUT "CHIPBREAKER"?

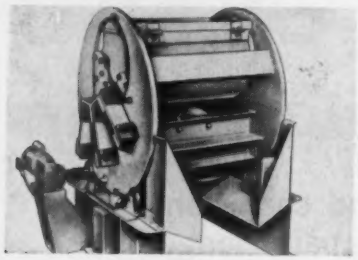


THE PATENTED RIB
that cannot be duplicated

SPECIFY
SPEEDICUT "CHIPBREAKER"
SPEED WITH SAFETY

*U.S. Patent Number 2769352

SPEEDICUT DIVISION • CHICAGO HEIGHTS STEEL CO. • CHICAGO HEIGHTS, ILL.



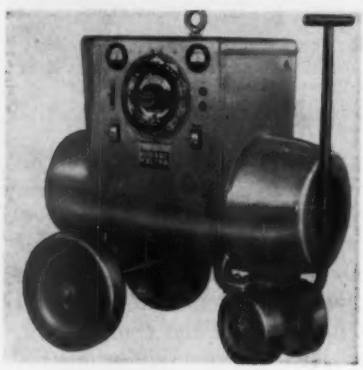
Barrel Finishing Machine Has Pushbutton Operation

Model VB-6, with capacity of 6 cu ft, deburrs, deflashes, polishes, or descales, and includes a pushbutton feature for rinsing or unloading. It completely finishes parts, rotates to the emptying position, and then the barrel tilts in order to simplify unloading—all automatically.

The electromagnetic drive produces 3600 vibrations per minute, more than adequate to keep both parts and abrasive media working 100% of the time. The unit finishes both heavy and light-gage metal, odd stampings, shielded areas, and recesses.

Syntron Co, 311 Lexington Ave, Homer City, Pa

MORE DATA? Circle 110, inside back cover



Arc Welder Line Incorporates Visor-Protected Panels

Meters and controls are protected by a visor which extends out over the entire control panel on this new line of dc motor generator arc welders.

All models have multi-range dual control with 10 main ranges of welding current and 100 steps of volt-amp adjustment in each range. Other controls include remote control, polarity switch, and motor start-stop-reset buttons. Rated at 60% duty cycle, 200, 300, and 400-amp models are available for either 50 or 60-c operation.

Hobart Brothers Co, Troy, Ohio

MORE DATA? Circle 111, inside back cover

THE ECONOMICAL APPROACH TO VIBRATION CONTROL

JACMOUNT

MACHINE MOUNTS

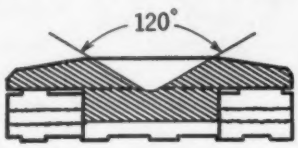
Jacmounts are designed for economy in machine mounts. While low in cost, they rate high in their ability to isolate shock and noise, and to dampen 85% or more of machine vibration.

Jacmounts are made in two units: a cast steel base plate — bonded to a heavy pad of shock absorbent Air-Loc®; and a jack screw assembly for accurate leveling. The base plate is recessed with a 1¼" diameter cone-shaped depression to accommodate the screw.

Jacmounts are easily installed, requiring no bolting or cementing.

BUY ONLY WHAT YOU NEED FOR YOUR MACHINES

Many machines already have jack screws furnished as original equipment. In this case, you buy only the base plate. Its conical recess has an included angle of 120° to take a wide range of screw diameters. If your machines are without jack screws, you buy the complete unit.



Conical recess will accommodate a wide range of screw diameters.

In either case, you'll get a mount of excellent stability and performance.

Jacmounts are adaptable to your mounting requirements. Call your local Air-Loc distributor now, or write for complete information.

Air-Loc® DIVISION

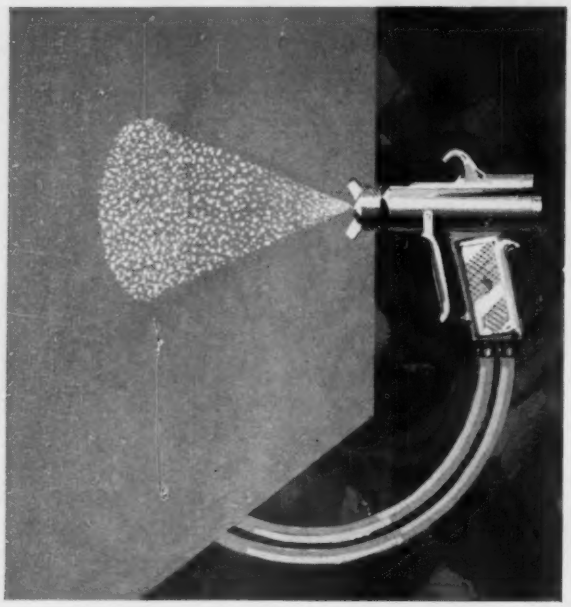
Clark, Cutler, McDermott Co.

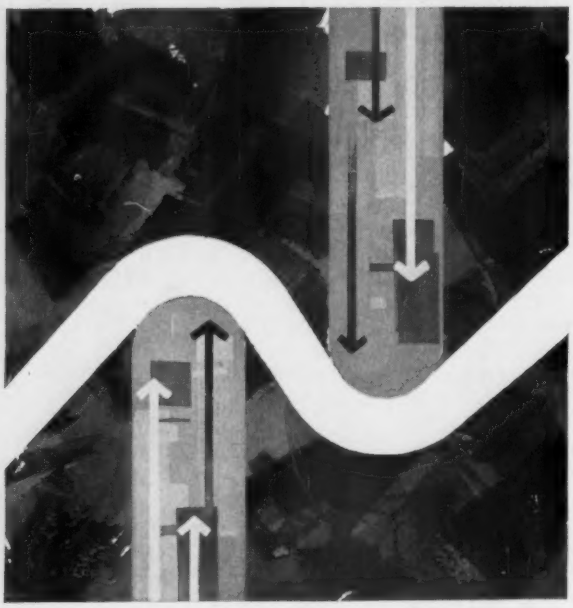
100 WEST CENTRAL ST. • FRANKLIN, MASS.

ARMCO'S SPECIAL COATED

Offer You Both Production

They provide low cost resistance to heat and corrosion, cut production costs; paintable grades hold paint longer





New Armco ZINCGRIP A, PAINTGRIP

Tests show this new Armco Steel has better paintability than any other zinc-coated steel prepared for painting. Its *spangle-free*, hot-dip zinc coating is specially-treated to take an extra-smooth paint finish after fabrication without additional surface treatment. Painted parts can be produced with superior finish at minimum cost. Durability is assured because the special zinc coating prevents rust and failure when paint is worn or chipped. It also eliminates the necessity of painting unexposed areas. ZINCGRIP® A, PAINTGRIP® has the same cost-cutting workability as shop-proved ZINCGRIP, plus improved spot-weldability.

Armco ZINCGRIP Steel

With this Armco Steel your products get the complete protection of a special hot-dip zinc coating that won't flake or peel even in severe drawing operations. Produced by the Armco-developed Sendzimir process, ZINCGRIP has a tightly adherent full-weight commercial zinc coating that is uniform in thickness and composition. It not only assures low-cost over-all protection against rust and corrosion, but its excellent fabricating characteristics simplify and speed production. In use for more than a quarter-century, ZINCGRIP Steel gives you the opportunity to add sales value to your products, often at less cost.

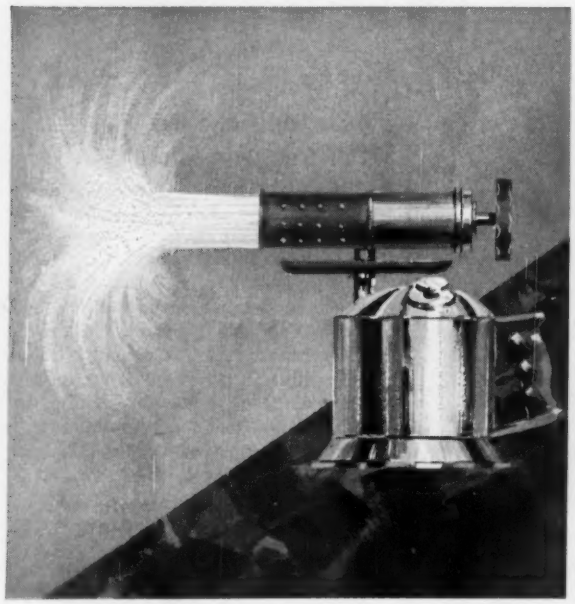
Write us for complete information on each of these Armco Special Coated Steels. You'll see how their unique advantages may improve the performance of your products and cut production costs as well.

Armco Division, Armco Steel Corporation, 1991 Curtis Street, Middletown, Ohio.

For Durability, Economy and Strength — Steel

New steels are born at Armco

STEELS
and Design Advantages



Armco ALUMINIZED STEEL Type 1

This special hot-dip aluminum-coated Armco Steel combines the surface characteristics of aluminum with the strength and economy of steel. It has cost-cutting advantages provided by no other metal in its price class. ALUMINIZED STEEL Type 1 has excellent resistance to a combination of heat and corrosion. It provides high heat reflectivity, good fabricating characteristics, and excellent physical and mechanical properties. In its price class, it is unmatched in economical durability for gas-fired heat exchangers and combustion chambers, automobile and truck mufflers, ovens, and similar applications.

Armco ALUMINIZED STEEL Type 2

Outstanding property of this hot-dip aluminum-coated Armco Steel is its low cost, lasting protection against atmospheric corrosion. The steel base of this two-in-one metal also assures strength, rigidity, and other basic advantages of steel Atmospheric corrosion tests and service experience demonstrate that the coating on ALUMINIZED STEEL Type 2 outlasts unpainted commercial galvanized coatings by a ratio of 4 to 1. For products exposed to the atmosphere or moist conditions, such as building panels, roofing, siding, drying ovens, and farm equipment, it assures dependable durability at minimum cost.

ARMCO **Armco Division**

ONLY

GOSS and DELEEUW AUTOMATIC CHUCKERS

offer the **1-2-3** *feature*

This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economicaly in any quantity.

The unique "1-2-3" feature, exclusive with Goss & DeLeeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

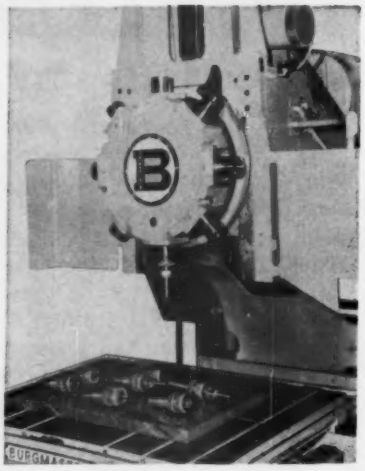
GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

15-in. Drillpress Has Full 6-in. Quill Stroke

Model 1150 incorporates a complete speed range and full 6-in. quill stroke in a single unit. The adjustable speed model provides speeds of 475 to 4800 rpm, and the new five-speed model has speeds of 400, 840, 1580, 2800, and 5300 rpm. Both units have heavier spindle bearings, longer quill, and a heavier 3-in. column for reduced deflection. They are equipped with a 10-spline spindle.

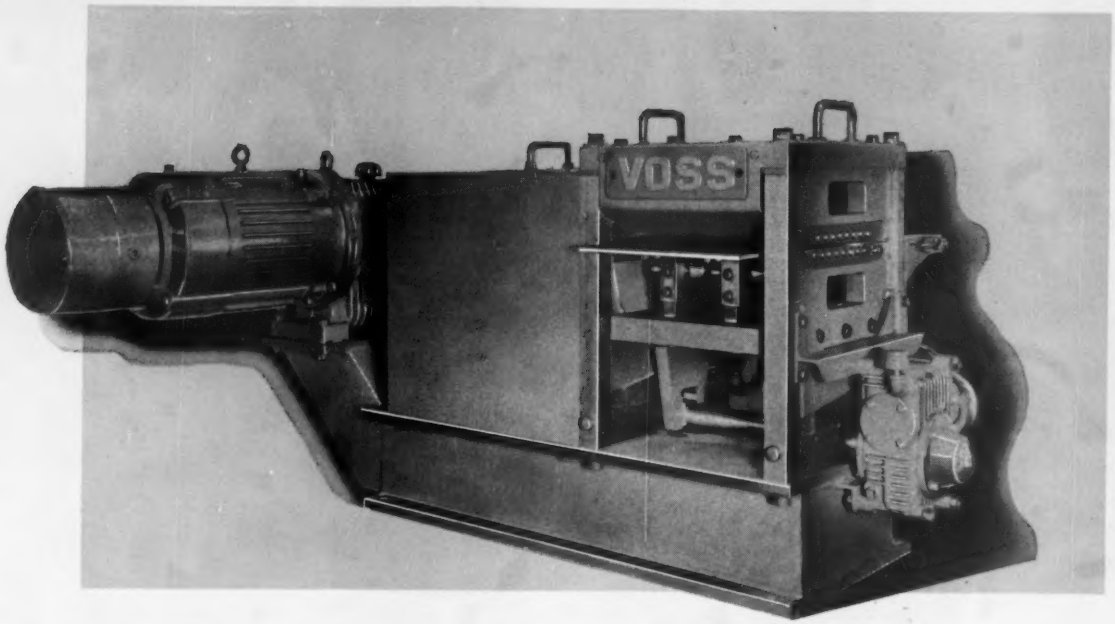
Powermatic Machine Co, McMinnville, Tenn

MORE DATA? Circle 112, inside back cover



FASTER SETUPS FOR PRODUCTION runs are possible with hollow spindles on the Burgmaster turret drilling, tapping, boring and milling machines. Hollow spindles allow tools to be preset to length while the machine is operating and also speed up replacement of dull tools. Other advantages include reduction of tool overhang and vertical travel of the turret, and increased ability of the tools to take heavy cuts—*Burgmaster Corp, 15001 S Figueroa St, Gardena, Calif*

MORE DATA? Circle 113, inside back cover



HERE'S THE MACHINE THAT'S REVOLUTIONIZING STAMPED PARTS-FLATTENING*

DEAD FLAT—FAST! That's what the Voss stamped parts-flattener does. As fast as it's fed, it achieves within .005 of dead flatness—*in one pass.* Eliminates hand flattening on an enormous variety of stamped parts. Can even be engineered to flatten parts having irregular surfaces.

COMPACT: Most models are compact enough to sit on a desk top. Yet the flattener inherits the ruggedness of the famed Voss Precision Roller Leveler.

* One major user reports that 2 Voss parts-flatteners and a few operators have replaced 300 workers engaged in hand flattening operations.

We'll be glad to arrange a demonstration with your parts, without obligation.

Voss ENGINEERING CO.

7301 Penn Ave. Pittsburgh 8, Pa. Churchill 2-4422

(Makers of the Voss Precision Roller Leveler)

ONLY J&L MAKES COLD FINISHED WIDE FLATS THAT ARE "MACHINE-SHOP PERFECT"

BECAUSE ONLY J&L COLD ROLLS FIRST, THEN DUPLEX MILLS THE EDGES.

J&L cold finished wide flats (six inches and up) are cold rolled and leveled—*then* the edges are duplex milled. Result? Wide flats with precise and uniform tolerances from bar to bar. Edges that are perfectly square and true.

Only J&L produces tool-and-die quality, "machine-shop perfect" wide flats. Operators depend on them for stripper and bed plates, dies, jigs, fixtures and machine cams that are accurate and uniform, require less machining.

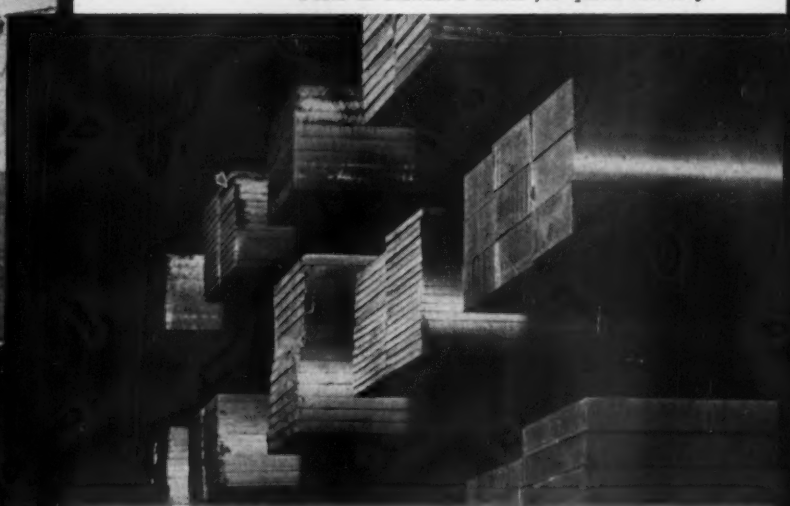
These prepared, machined flats are readily available from your local Steel Service Center in widths up to 14⅝" and in thicknesses from ⅛" to 2½".

Jones & Laughlin Steel Corporation

3 GATEWAY CENTER, PITTSBURGH 30, PENNSYLVANIA

Where cold finished steel bars originated in 1859

Your Steel Service Center stocks J&L Wide Flats as standard items for quick delivery.



J&L Wide Flats are duplex milled after rolling to give you uniformly square edges that reduce or eliminate further machining.

Steel

Steel's Symbol of strength, long life, and economy.

CIRCLE 379 READER SERVICE CARD

NOW INTRODUCING THE . . .

JARVIS

Dril-King

No. 65 for Drilling • No. 66 for Drilling & Tapping

LOWEST PRICED AMERICAN MADE UNIVERSAL DRILLING & TAPPING MACHINE

Basic Drilling Machine Price Starts at Only $1795.00 (Less Spindle Assemblies)

Floor Type, Self-Contained Universal Joint Drilling & Tapping Machine.

Designed for Small Parts Production Where Small Hole Drilling and Tapping is Required.

12 Spindle Drivers, 4 Speed Selections. T Track Vertical Feed Work Table.

Capable of Standard Center Distances down to .390, closer upon specific application.

- Head remains stationary while counter balanced table feeds work pieces up to drills or taps.
- Rapid changeover from one job to another. Well suited for either short or long runs.
- Work table features 2 "T" tracks, has adjustable depth stops. Depth controlled either mechanically or electrically.
- Standard spindle assemblies can be arranged in jig bored cluster plates to your prints, or used with adjustable arms. Over 35 standard spindle assemblies available to fit any job.

Overall Height 66"
Height from floor to Work Table 39"

WRITE, PHONE OR SEND COUPON FOR FACTS AND FIGURES

Jarvis CORPORATION
Telephone Diamond 7-3321
Precision Pioneers For Years

JARVIS CORPORATION
26 Pease Ave., Middletown, Conn.

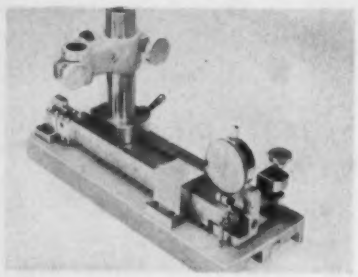
☐ Have Representative call
☐ Send "Dril-King" Brochure

Name _____

Company _____

Street _____

City & State _____



Instrument Checks Displacement Transducers to 0.000,001 in.

Model TK-501 will check displacement-type transducers such as LVDT, strain gage, and variable reluctance to within 0.000,001 in. To check a transducer, it is clamped securely in the bracket mounting and positioned by a knurled elevating knob until the transducer extension touches one end of a lever arm. A fine adjusting screw displaces the other end of the arm slowly and deflects a pre-set mechanical dial indicator so that a comparison between actual deflection of the transducer and its voltage output is accurately measured.

Price with an adaptor for checking mechanical drive indicators with ⅜ in. dia shanks is $400.

Technirite Electronics, Inc, 73 Centerville Rd, Warwick, RI

MORE DATA? Circle 114, inside back cover

Dries & Krump Offer Two 25-ton Light Duty Chicago Press Brakes

Light duty press brakes, with 25-ton capacity have welded steel plate frames, deep section bed and ram adjustable ram, and a stroke of 2 in. Model 265 has an overall bending length of 72 in., a capacity range of 66 in. of 14 gage to 48 in. of 12 gage mild steel. Model 285 has an overall bending length and capacity of 96 in. of 18 gage mild steel.

Dries & Krump Mfg Co, 7400 South Loomis Blvd, Chicago 36, Ill

MORE DATA? Circle 115, inside back cover

Note that sizes are etched on the *sides* of the blocks so that they always are visible and can be easily read even when wrung together

Even the case is more productive—self-indexing, and designed so that the user need not touch the gaging surfaces to remove the blocks.

a DoALL PRODUCTIVITY-PLUS product

STAINLESS STEEL Gage Blocks

...a lot more value for just a little more money

LONGER LIFE . ASSURED ACCURACY . FASTER, EASIER GAGING . LOWEST COST IN THE LONG RUN

You'll greatly increase the productivity and reduce the cost of your gaging operations when you buy DoALL *stainless steel* gage blocks. No other blocks give you such an impressive list of economic plus values:

Wear life is triple that of ordinary steel gage blocks.

Extraordinary stability—independent laboratory tests show no measurable dimensional change after 24 months.

Coefficient of expansion in the range of nearly all ferrous metals, eliminating error-producing, time-wasting temperature compensations required, for example, with chrome carbide blocks.

0.09 RMS surface finish—far superior to that available on blocks of any other material or make; assuring greater accuracy, easier wringability, and maximum wear life.

High Brinelling resistance—repeated spindle impacts will not Brinell these stainless steel blocks.

Four to five times greater corrosion resistance than regular steel blocks.

68-72 Rockwell C hardness—for longer life with fewer recalibrations.

LOW PRICE. When you consider the greatly extended wear life, the unequaled finish, the workable coefficient of expansion, the ultra-stable accuracy, and the ease of wringability of DoALL stainless steel gage blocks, you will find that they give you more practical value, dollar for dollar, than any other blocks you can buy. For example, a 2" AA grade SS block at $18.25 costs *only $5.75 more* than a standard steel block and *as much as $41.75 less than* a chrome carbide block.

Get all the facts—ask for a demonstration. Call DoALL today.

THE DoALL COMPANY, Des Plaines, Ill.
Serving you locally through your DoALL Sales-Service Store

GB-41

DoALL . . . the Productivity People

*Reg. T.M.—The DoALL Company

CIRCLE 381 READER SERVICE CARD

CALL YOUR DoALL SALES-SERVICE STORE

MACHINE TOOLS

Price $10,336 — Rent $56.21 per week
Model 2613-3
Contour-matic®
23 types

BAND MACHINES

Price $1475 — Rent $9.46 per week
Model DH-612
6" x 12"
12 types

SURFACE GRINDERS

Price $2761 — Rent $17.70 per week
Model C-12
6 types

POWER SAWS

CUTTING TOOLS

18 types
All sizes

MEASURING INSTRUMENTS

SHOP BLOCKS® 84 pcs.

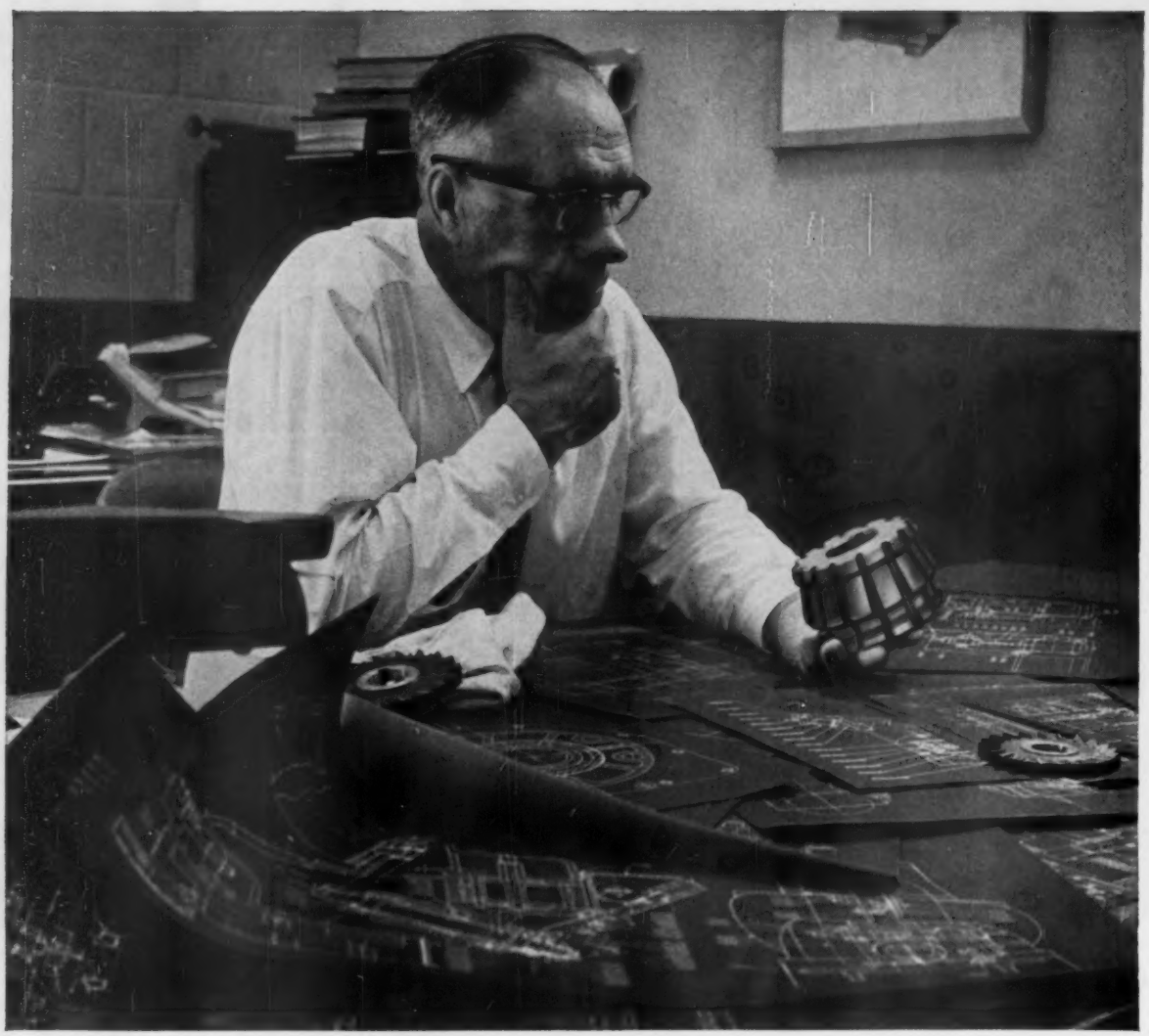
Price $365

18" x 24" Price $80
All sizes, grades

SHOP SUPPLIES

For Every Purpose
2,000 Sizes • grades

Find Your DoALL STORE In The "Yellow Pages"



WHICH

MAKES THE BEST CUTTER?

Quality cutting tools reduce the cost of producing quality in your shop. The question is: How do you make sure about the quality of the design when you buy SPECIAL CUTTERS? The engineering available to you as a Barber-Colman

customer may be worth many times the price of the tools you buy. Our analysis of a milling operation often uncovers new ways of reducing costs through tool design—for example, economical combinations of cuts in a single operation. To provide you with more effective development man-hours per tool and maximize design flexibility, our engineers use electronic computers. From complex form data with design variations and modifications, the machines calculate specifications accurately and fast. Early consultation with our field or factory specialists can make these facilities and services available in the workpiece design stage. Perhaps we can make a cutter to produce a form you want but may think impractical. In addition to optimum cutter design, Barber-Colman offers proprietary innovations in cutting tool manufacture—in high-speed steel and carbide metallurgy and manufacturing technique. Prototype tool development, tooling, manufacturing, and inspection are done on specialized equipment not duplicated anywhere. Start by asking for a complete evaluation of your milling jobs by a Barber-Colman cutting tool specialist—a practical man who has come up through our

DESIGN

engineering department and knows how to solve your problems.

BARBER COLMAN

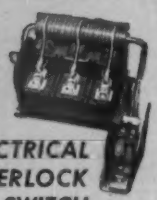
111 LOOMIS STREET, ROCKFORD, ILL.

BARBER-COLMAN COMPANY

All these Square D features make this

THE SAFEST, MOST RELIABLE COMBINATION STARTER

VISIBLE BLADES You can see the switch is open and know you're safe!



REALLY DUST-TIGHT

NEMA 5-12 construction keeps out dust and coolant. Positive door-closing mechanism assures complete seal before switch can be operated.

DOOR CLOSES SIMPLY and EASILY

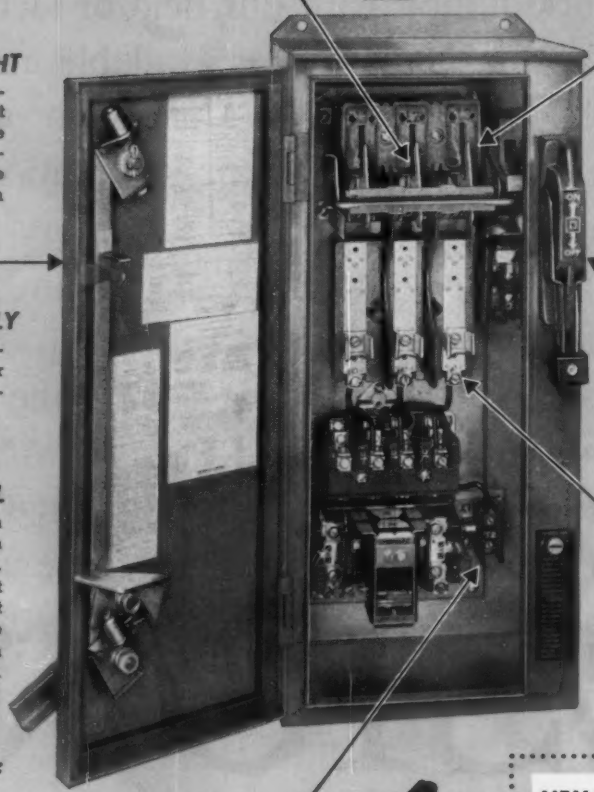
No cover bolts to secure—just push door shut and turn door handle to close and seal.

EASY TO INSTALL

Through wiring with no interference from disconnect switch. Line terminals are at top, load terminals at bottom. Starters can be ganged with less than ½ inch between them.

WIDE RANGE OF SIZES

New Square D combination starter now available in NEMA Sizes 0 through 4.



ELECTRICAL INTERLOCK ON SWITCH

Optional single or double-pole interlock available to disconnect separate control circuit power. Assures complete safety!

FOOL-PROOF OPERATING MECHANISM

Handle is permanently attached to switch to eliminate hazard of false handle indication. With door open, the switch can not be operated accidentally.

CONVERTIBLE FUSE CLIPS

If horsepower or voltage requirements change, modification kits provide easy change of fuse clip size and spacing.

3rd OVERLOAD RELAY

Space to add an additional overload relay when desired.

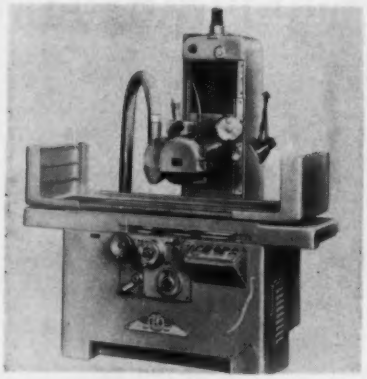
NEMA TYPE 1 ENCLOSURE ALSO AVAILABLE

NEMA Type 1 enclosures, offered in Sizes 0 through 4, can be modified by addition of a pushbutton, selector switch or other accessories. Easy-to-use kits simplify field installation.

Write for Bulletin SM-292. Address Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wis.

SQUARE D COMPANY

wherever electricity is distributed and controlled



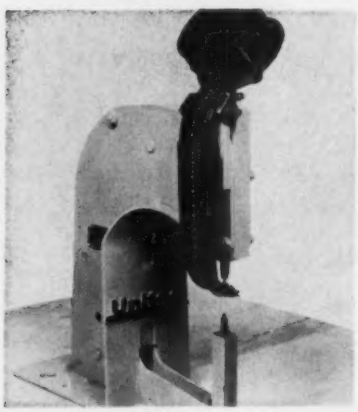
German-Made Surface Grinders Available in 35 Models

Complete line of ELB high precision surface grinders are offered in sizes ranging from 6x12x7-¾ in. to 59x197x39-½ in.

Major features are fully automatic work cycle; simplicity of operation; increased output because of wide cross-feeds (up to 2⅜ in. per table stroke); automatic copy grinding, sizing equipment; and return of wheelhead to starting position.

Dist by Alina Corp, 122 E Second St, Mineola, Long Island, NY

MORE DATA? Circle 116, inside back cover



Motor & Hopper Convert Eyelet Machine to Automatic Operation

Conversion for increased eyeletting speed adds a hopper and raceway to the Model A eyeletting machine and substitutes an electric motor drive for the original foot power. Addition of these features, which will give the machine a cycle time of a little more than a third of a second, can be done in the field or at the factory. Price of the basic machine is less than $100; with the hopper it is $135 and with the motor, $295.

Fastener Div, United Shoe Machinery Corp, Shelton, Conn

MORE DATA? Circle 117, inside back cover

BISCA
is the
Basic File
for cutting metals and costs

DELTA BISCA FILES

- Have unique tooth structure designed for fast cutting
- Remove metal rapidly—yet leave smooth finish
- Last up to 40% longer than other files
- Cut Brass, Iron, Steel, Copper, Aluminum Alloys and even tough Plastics with equal efficiency
- Are available in flat, half round and square shapes

That's why Bisca is the Basic File for you.

Order BISCA FILES from your ▶ DELTA INDUSTRIAL DISTRIBUTOR

DELTA FILE WORKS, INC. • A PLUMB SUBSIDIARY • PHILADELPHIA 37, PA.

Lincoln Electric's plan for...

COMPLETE WELDER REMANUFACTURING..

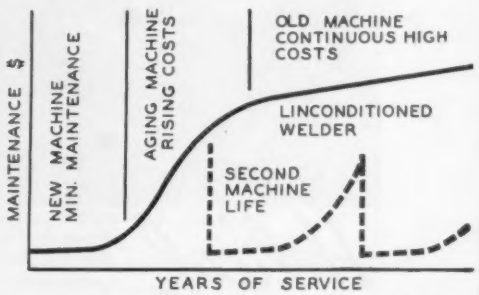
Machines returned to the plant for remanufacturing are completely torn down and rebuilt with new parts where needed. All work is done at published prices known beforehand. Owner receives new machine guarantee on completion of the work.

. . . REDUCES CAPITAL INVESTMENT, PRESERVES PROFITS

If you own Lincoln welding equipment, you know it traditionally outlasts other makes. Routine maintenance is all that's needed to keep it in top operating condition. But any machine reaches a point where mounting repair costs indicate the need for a complete overhaul. Lincoln provides a complete factory remanufacturing service for owners of Lincoln equipment. It's called Linconditioning. Because Linconditioned welders carry a new machine guarantee, effective life of your welder is extended 100% at about half the cost of a new machine. This kind of service, we believe, helps Lincoln customers battle indirect costs, preserve hard-to-keep profits.

Your welder is disassembled right in the Lincoln plant by trained factory mechanics; then completely overhauled and remanufactured. Parts are restored to like-new condition. Those beyond repair are replaced with the same new parts which go into brand-new machines. Here, frames from generator-type machines are vapor-degreased. Dirt and dust is removed from the coils which are then tested for grounds, shorts and electrical balance. Each must test out like new before assembly.

Gas and diesel engines for portable welders are thoroughly reconditioned, too. Blocks are cleaned, inspected for cracks, sizes and general condition. Cylinders are re-bored, honed to proper oversize and finish. Valves and crankshafts, checked for wear, are reground and buffed. New piston rings are precision-fitted to bore size. After re-assembly, engine is idle-run to wear in.



Here's a graphic expression of Linconditioning. When a machine is new, it requires little if any maintenance. As it ages, the occasional service it needs can be obtained from your local Lincoln field service shop. But eventually, the frequency of repairs causes constant expense. At this point, Linconditioning restores your machine to new condition, doubles its effective service life . . . all at a price varying from 40-50% of the cost of a new machine. Find out more about this money-saving remanufacturing plan now. Contact your local Lincoln field engineer. Or, write for bulletin 9100.1.

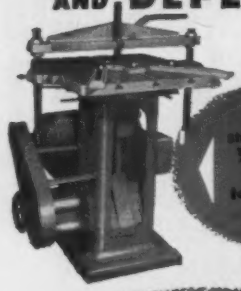
THE LINCOLN ELECTRIC COMPANY • DEPT. 1661 • CLEVELAND 17, OHIO

LINCOLN WELDERS

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

CIRCLE 387 READER SERVICE CARD

FOR EFFICIENCY AND DEPENDABILITY USE



Northfield KEYSEATERS
This keyseater is designed to cut straight or tapered keyways from ⅛" to 1" wide. Work of any shape and diameter can be clamped to the table and cut, grooved, or slotted.

Northfield BAND SAWS
Speed, precision, dependability, value, all are painstakingly built into the Northfield 36" Band Saw. Speeds can be altered for different metals, plastics, fabrics, woods, etc.

Northfield CIRCULAR SAWS
A heavy duty, accurately constructed machine with every feature for circular sawing in any shop. Adaptable for cutting light metals, plastics, woods, etc.

WRITE TODAY FOR LITERATURE AND PRICES!

Northfield FOUNDRY & MACHINE CO.
★ ★ ★ NORTHFIELD, MINNESOTA, U. S. A.

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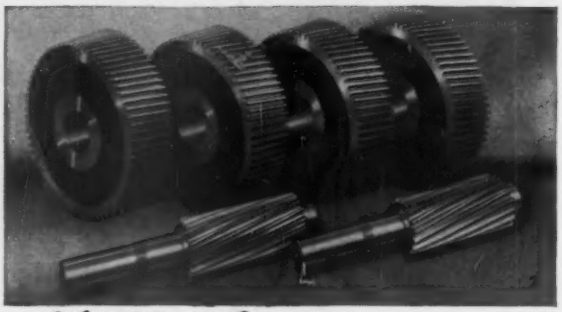


Helical GEARS AND PINIONS

Ready for long, trouble-free use in bar straightening equipment, these precise examples of Stahl's craftsmanship in gear fabrication have been double-checked for strict compliance with specifications. Illustrated are 4 steel helical gears—24.697" F., 72 T., 3 D.P., together with 2 Hyten B3X steel shaft pinions 6.758" O.D., 16¾" F., 35" Length-over-all. Heat treated. Let Stahl end your gear worries—send for our estimate.

SPURS TO 72" PD. 1 DP
BEVELS TO 54" PD. 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD. 2 DP
CONTINUOUS TOOTH HERRINGBONE TO 60" PD. 2 DP
SPROCKETS TO 72" PD. 2½" CP
RACKS TO 20 FT. LONG, 3 DP
SILENT GEARS: RAWHIDE, BAKELITE, FIBROIL
HEAT TREATED CASE OR FLAME HARDENED GEARS—OF CARBON OR ALLOY STEEL

Stahl
GEAR & MACHINE COMPANY
3901 HAMILTON AVENUE
CLEVELAND 14, OHIO

NEW SHOP EQUIPMENT

Weld-Edge Hole Saws Introduced by Simonds

New line of hole saws is designed for cutting of holes in any machinable material up to 1⅛ in. thick. They can be used in portable tools, drillpresses, lathes, boring mills, and milling machines. Floating pin-drive arbor assures non-slip cutting.

Special wear-resistant high-steel cutting edge keeps saws sharp for long periods. Cutting edge is permanently bonded to a tough alloy steel body for maximum strength. Knock-out slots make removal of cores fast and easy. Follow-through cap design permits sawing of deep holes in stacked or layered materials where cores can be removed. These saws are available in a range of hole sizes from 9/16 to 6 in. and in mandrel sizes for light to heavy cutting.

Simonds Saw & Steel Co, Fitchburg, Mass

MORE DATA? Circle 118, inside back cover

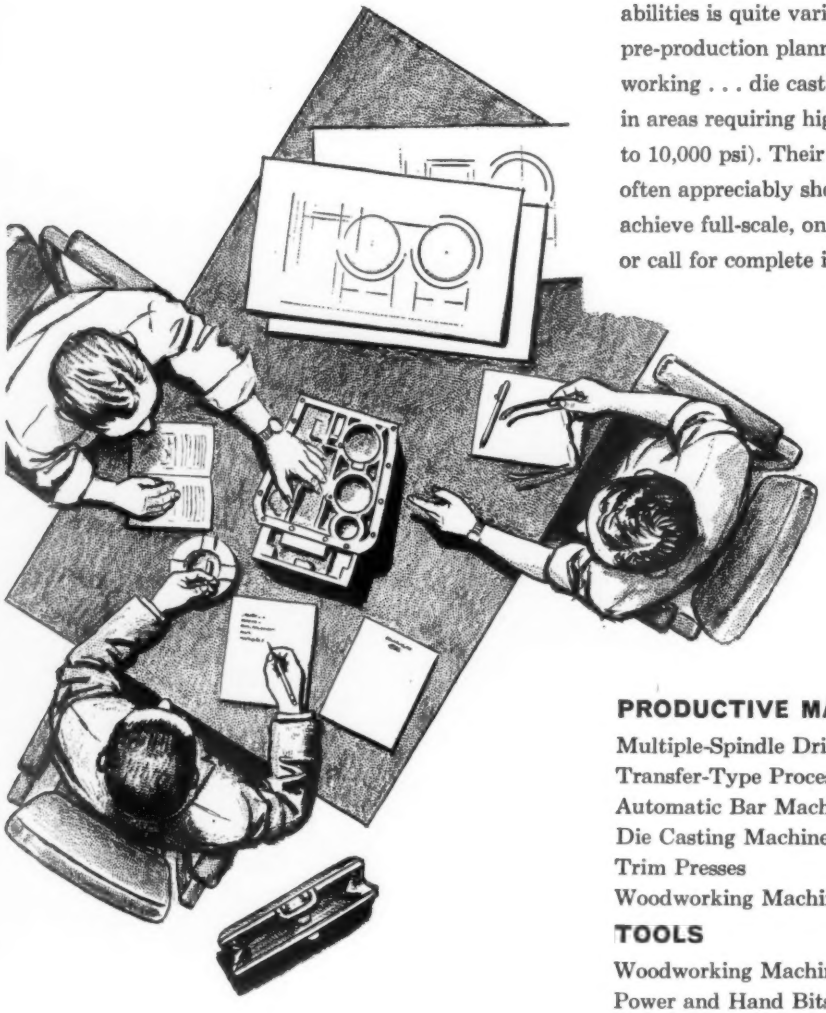
TRANSISTORIZED ELECTRONIC gages capable of measuring dimensions as small as two millionths of an inch are available as battery-operated units or for 110 v ac operation. Units are part of a system that includes two amplifiers, choice of height gages, bench comparators, dice thickness gages, and a gage head—*Techni-Rite Electronics, Inc, 61 Centerville Rd, Warwick, RI*

MORE DATA? Circle 119, inside back cover

Cooperative Engineering...

TAKES SKILL AND EXPERIENCE

The Greenlee engineering group is well-qualified to help you with your most difficult and complex manufacturing problems. Their highly developed skills and wide background of experience has helped save thousands of dollars in capital equipment and reduced unit costs. Their range of abilities is quite varied. They can help you with pre-production planning in the fields of metal-working . . . die casting . . . woodworking . . . and in areas requiring high pressure hydraulics (up to 10,000 psi). Their suggestions and advice can often appreciably shorten the time required to achieve full-scale, on-the-line production. Write or call for complete information.



PRODUCTIVE MACHINES

Multiple-Spindle Drilling and Tapping Machines
Transfer-Type Processing Machines
Automatic Bar Machines (Six and Four Spindles)
Die Casting Machines
Trim Presses
Woodworking Machines

TOOLS

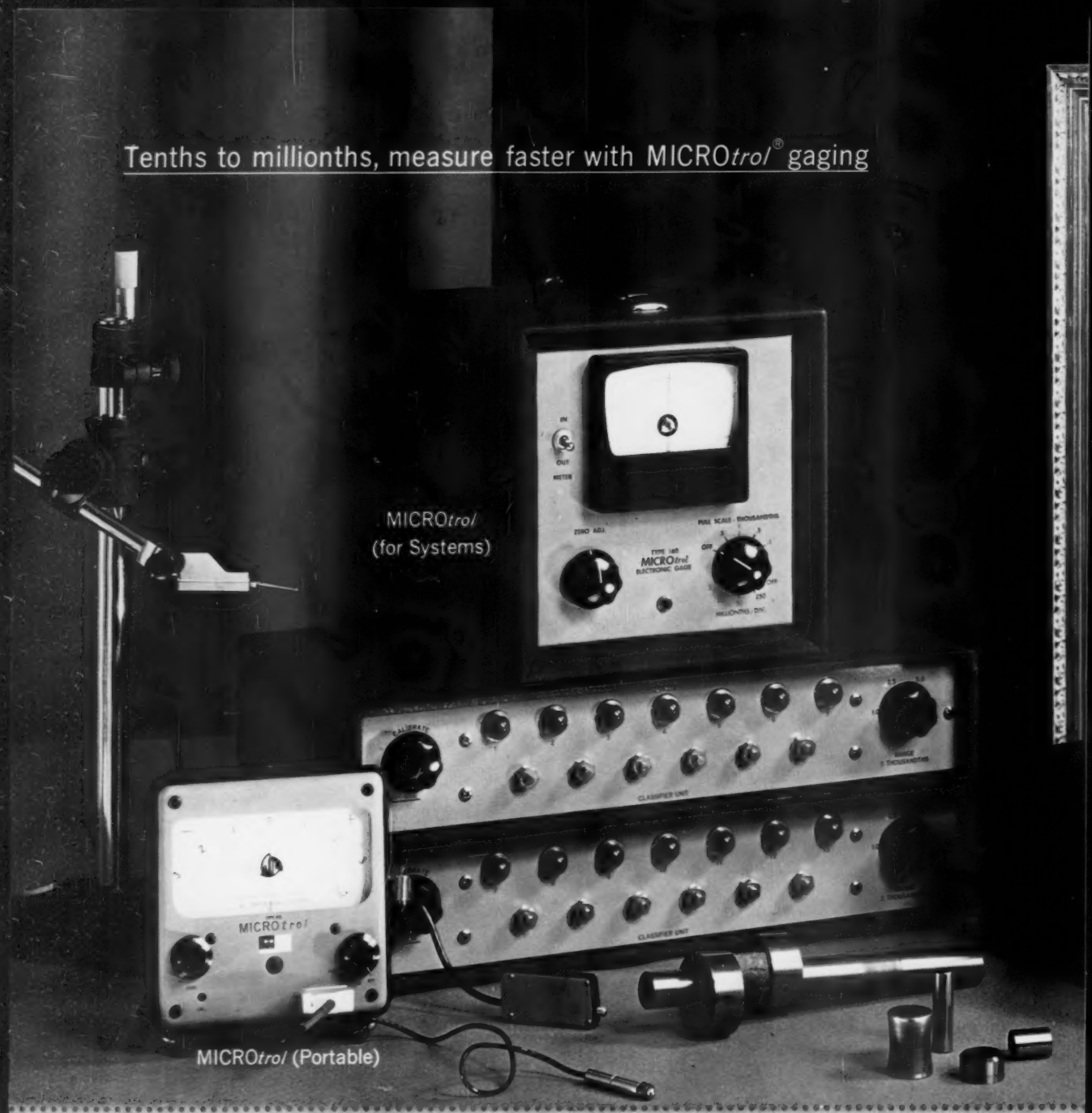
Woodworking Machine Bits
Power and Hand Bits
Hand and Hydraulic Knockout Punches
Hydraulic and Mechanical Pipe Benders
Portable Hydraulic Pumps to 10,000 PSI

Phone: WOodland 3-4881
Teletype RK 7683

PRODUCTION MACHINERY
GREENLEE BROS. & CO.
Since 1863 ROCKFORD, ILLINOIS, U.S.A.

▲ CIRCLE 390 READER SERVICE CARD

CIRCLE 391 READER SERVICE CARD ►



Lightweight, transistorized; battery or ac powered, MICROtrol Type 170

Use this fast, accurate gage at the machine, in production, in inspection, in the laboratory.

It's rugged and lightweight because it's transistorized. Four interchangeable gage heads readily cover the whole range of normal gaging setups.

FEATURES: Weight only 3 lbs. Easy to operate; just 2 knobs. Two dual range models: ± .0003 to ± .003; or ± .001 to ± .010. Pocket sized. Accurate. Basic gages from $341.

Your first step to automatic quality control of machine tool production is MICROtrol Type 160

With this complete family of electronic equipment you can range from fast and accurate measurement of dimensions on the bench to complete control of manufacturing in the plant.

With accessories you can get automatic inspection, automatic sorting, or complete closed-loop control.

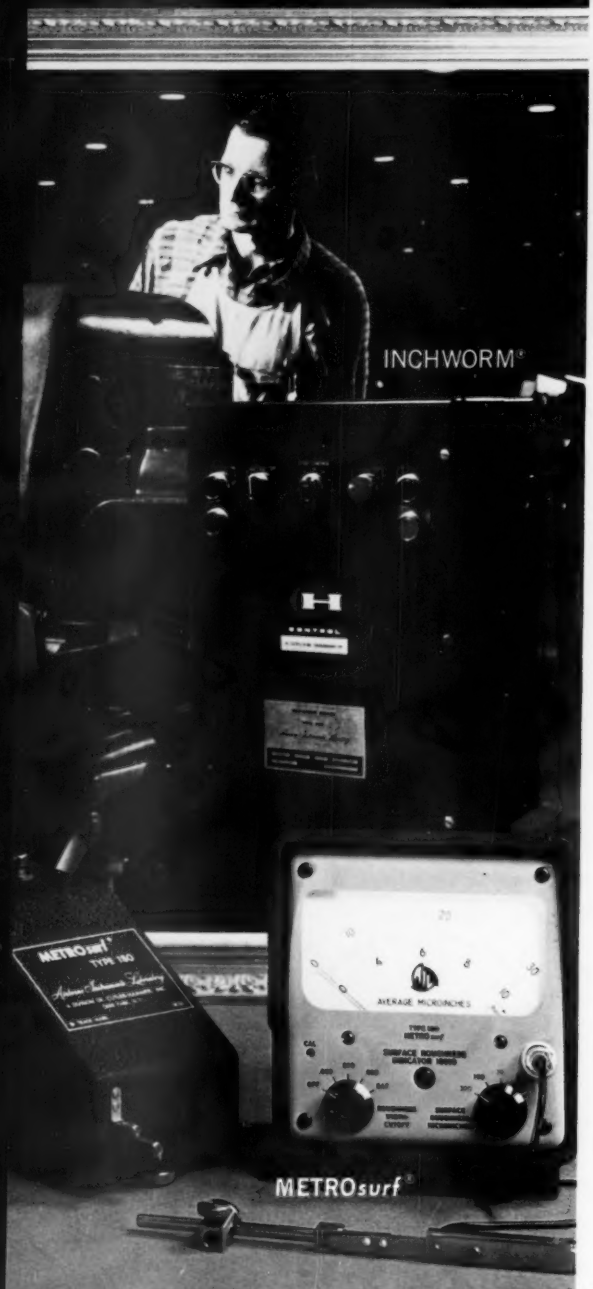
FEATURES: 4 scale ranges available. Repeatability to 0.000005". High stability and reliability. Comparator systems from $764.

Now with new motor drive Transistorized METROsurf Type 180 measures surface roughness at less cost

METROsurf is the low-cost, high accuracy way to end the hazards of measuring surface roughness by touch or sight.

It's fast. It's portable. You can use it at machine or bench. Battery or ac models available.

FEATURES: 5 range selections; 3 to 300 microinches full scale. Big dial. Motor-driven or hand-held tracer. Amplifier and tracer head, $495.



CONTROL
CUTLER-HAMMER
AIL DIVISION

These Cutler-Hammer systems and gages hold metalworking to precise tolerances AUTOMATICALLY

To reduce inspection time and cost, Cutler-Hammer supplies the precision metalworking industry a range of gaging and control devices whose building block concept provides great versatility.

You can start with a MICRO*trol* gage or an INCHWORM motor. Then or later, you can add from a choice of accessories. These allow you to inspect, sort, reject, record quality . . . correct machine tools and stop them from making scrap . . . *completely automatically.*

These gages and systems are products of a company that's a leader in advanced military and space electronics, vastly experienced in control for industry. The science is there. The engineering is there. The reliability is there.

You'll be interested in the accuracy, the speed, the inspection and production savings. Contact a Cutler-Hammer sales office, check the publication inquiry number, or mail the coupon today for complete information. Gaging inquiries will be handled by gaging specialists.

Get more accurate production, fewer rejects with INCHWORM Type 202

Centerless grinders are freed from backlash, can maintain required tolerances in a way that will amaze you, when INCHWORM replaces the lead screw!

INCHWORM's ability to move either direction in microinch steps increases production as well as accuracy.

With automatic inspection and simple logic systems, INCHWORM will correct any off-dimension trends automatically. A virtual end to grinding scrap!

FREE TRIAL. Retrofit an INCHWORM to your grinder at our expense. Count your savings during the trial. Then prices start at $3,400 . . . usually quickly recovered.

WHAT'S NEW? ASK...

CUTLER-HAMMER

AIL Division, Deer Park, L. I., New York

Send FREE literature on ☐ Type 170 MICRO*trol* ☐ Type 160 MICRO*trol* ☐ METRO*surf* ☐ INCHWORM

Please check ☐ Send literature only ☐ Have a representative contact me

Name_____

Title_____

Company_____

Address_____

City_____ State_____

Moore lapping specialists given ±12½ millionths "tolerance area" with 18" Measuring Machine Master Lead Screws

The guaranteed tolerance of the Moore Measuring Machine Master Lead Screw is that it will have no more than 35 millionths error in its full travel.

Actually, our lapping specialists work in a "tolerance area", as graphically shown in Chart A. The shaded area would, in general, correspond to Moore's *shop* "tolerance area," with the added stipulation that only small progressively minus lead errors be allowed. The straight line drawn through the center of the shaded area would then be equivalent to the "centerline" of Moore's tolerance area.

Moore lapping specialists correctively lap the Measuring Machine lead screw, while maintaining uniform pitch diameter, within this area or, in effect, to a ±12½ millionths tolerance!

Such a tolerance is made possible by Moore's advanced lead screw and machine design as well as its meticulous attention to each element involved in machine positioning accuracy.

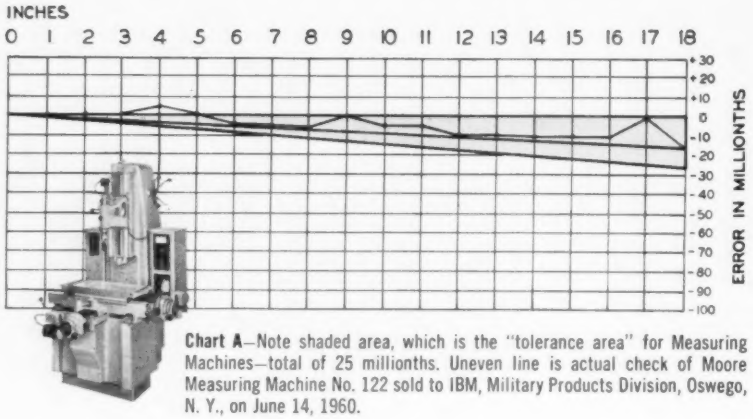


Chart A—Note shaded area, which is the "tolerance area" for Measuring Machines—total of 25 millionths. Uneven line is actual check of Moore Measuring Machine No. 122 sold to IBM, Military Products Division, Oswego, N. Y., on June 14, 1960.

To assure accuracy of positioning the same procedure is followed, with somewhat wider tolerance, for Moore Jig Borers and Jig Grinders, Chart B.

There are three reasons for Moore's deciding on a progressively "minus" lead screw:

1. It is possible that, from overzealous use, the screw might warm up as much as ¼°F. But a temperature rise would tend to make a "minus" screw progressively longer. In other words, this slight temperature rise would, if anything, make the screw closer to zero.

2. All Moore machines in the field will be alike. If machines were allowed to be indiscriminately plus or minus, they might *disagree* by 150 millionths.

3. It permits only minute errors from inch to inch. The extremely good *linear* characteristic of the Moore lead screw fits the requirement that smaller measurements are necessarily of a higher order of accuracy. For example (Chart A), with IBM's 18" master lead screw, any location between the 5th and 12th inch would have no more than 10 millionths error!

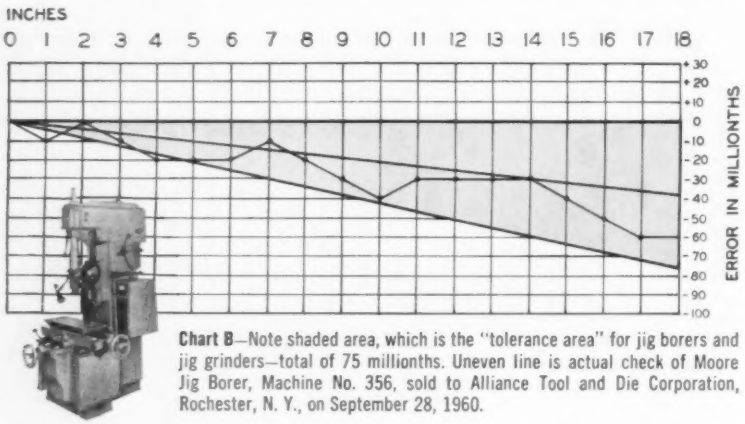
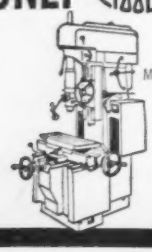


Chart B—Note shaded area, which is the "tolerance area" for jig borers and jig grinders—total of 75 millionths. Uneven line is actual check of Moore Jig Borer, Machine No. 356, sold to Alliance Tool and Die Corporation, Rochester, N. Y., on September 28, 1960.

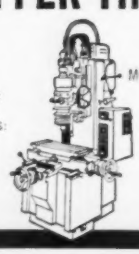
Detailed literature on the Moore No. 3 Jig Borer, Jig Grinder or Measuring Machine is available on request.

THE MOORE SPECIAL TOOL CO., INC.
738 Union Avenue, Bridgeport 7, Connecticut

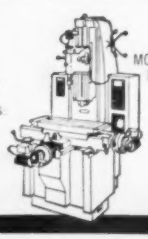
ONLY MOORE TOOLS CAN OFFER THIS COMPLETE PACKAGE OF PRECISION



MOORE NO. 3 JIG BORER
Greatest error in any inch: 30 millionths
Greatest error in 18 inches: 90 millionths



MOORE NO. 3 JIG GRINDER
Greatest error in any inch: 30 millionths
Greatest error in 18 inches: 90 millionths

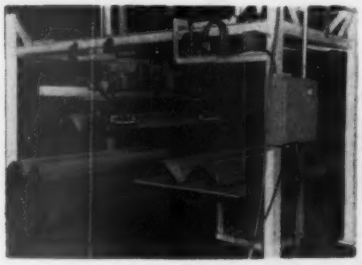


MOORE UNIVERSAL MEASURING MACHINE
Greatest error in any inch: 15 millionths
Greatest error in 18 inches: 35 millionths

MOORE ROTARY TABLE
Divides the circle to less than 2 sec.

◀ CIRCLE 392 READER SERVICE CARD

▲ CIRCLE 393 READER SERVICE CARD



Vac-U-Lift Feeds and De-Stacks 20-ft-long Material in 10 sec

New Vac-U-Lift automatic transfer unit is specially constructed to lift, transfer, and stack corrugated material up to 20 ft long in less than 10 seconds. It can be adapted to handle flat stock as well.

Unit, with chain-sprocket and ball bearing carriage, is completely self-contained and is powered by a compact air motor and reducer, permitting cushioned starts and stops. Air motor is valved to act as a brake when air supply is cut off. Lift mechanism is air cylinder and guide rod framework. Cycle starts when operator pushes button; unit continues feeding until material stack is depleted.

Vac-U-Lift Co, Salem, Ill

MORE DATA? Circle 120, inside back cover

COILED STOCK OILER deposits a controlled film of cutting oil on the top and bottom of coiled stock before it enters punch press dies. Oil is fed to the core of a pair of rollers and the flow is controlled to each roller by adjustable needle valves. Stock is wiped clean by a pair of squeegees before it enters the oiler. This model will lubricate stock up to 3 in. wide and 1/16 in. thick with oil from its refillable plastic reservoir—*Jaco Devices, 90 High Street, Hingham, Mass*

MORE DATA? Circle 121, inside back cover

SIMPLICITY
the key feature of
TRAUB AUTOMATICS

- Simple to set up
- Simple to operate
- Simple to maintain

TRAUB Single Spindle Bar Automatics can be used for both bar and chucking work. They produce efficiently, with the highest precision, and economically even on 50 piece runs. Every model is carefully tooled and job-proved before delivery and reliably serviced thereafter.

Single Spindle Bar Automatics come in 4 different models.

MODEL	A 15	A 25	A 42	A 56
COLLET CAPACITY	19/32"	1"	1⅝"	2¼"
12 SPINDLE SPEEDS	900-6,500 RPM	550-4,000 RPM	240-2,920 RPM	240-2,920 RPM

TRAUB Automatics are stocked in the U. S. and spare parts are readily available. TRAUB's factory-trained technicians stand ready to assist you anywhere in the U. S.

Write for illustrated catalog. Ask for a demonstration.

TRAUB

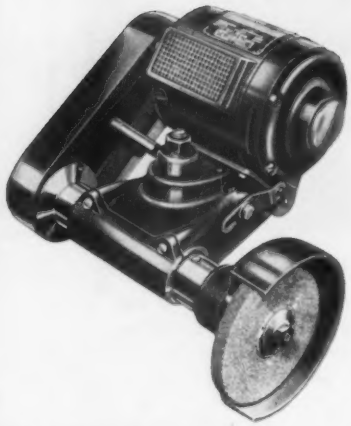
TRAUB U. S. A., INC.

South Terminal Drive & Commercial Street, Plainview, L. I., N. Y.

A direct-factory affiliate of Hermann Traub Machine Tool Works
Reichenbach/Fils West Germany . . . Dielsdorf, Switzerland

West Coast Rep.: Alexander Machinery Co., Inc., 5840 West Adams Blvd., Culver City, Calif.

10 WAYS TO GRIND AT LOWER COST...



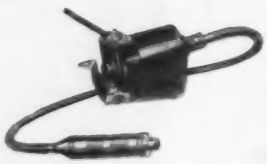
tool post grinders

Precision built for secondary grinding operations on lathes, millers, planers, shapers, grinders, boring mills to save handling, moving, set-up and down-time. Easily adapt to bench use or special machines. Deliver accuracy to .0001", surface finishes to 6 micro-inches. Easy, simple mounting and use by regular machine operators. 9 models, 1/14 to 3 hp., swing 1/8" to 12" wheels. Priced from $93, FOB Racine.

DUMORE® PRECISION GRINDING TOOLS

hand grinders

Rugged, lightweight, powerful. Balanced, precision construction provides true spindle alignment and rigidity for longer wheel life, maximum service on fine die work or rough deburring. 7 models, 1/20 to 1/4 hp. Priced from $41.50, FOB Racine.

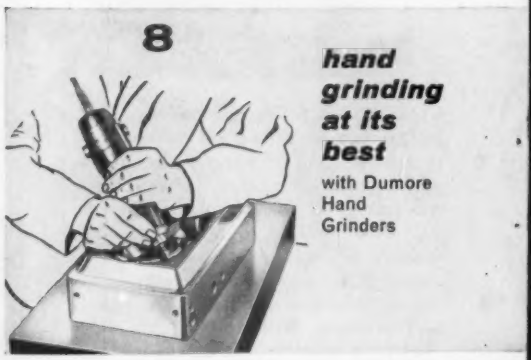


flex-shaft tools

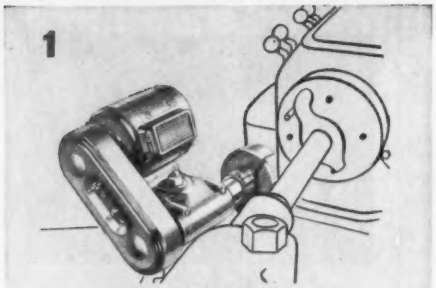
Easy-to-handle, power-packed, versatile. Speed cutting, polishing, routing, grinding, deburring on all metals and plastics. 3 models, 1/15 to 1/4 hp. Priced from $74.50, FOB Racine.

quills

Finest precision construction for use as interchangeable spindles on Dumore Tool Post Grinders...inexpensive heads in special set-ups...replacement spindles or high-speed attachments for standard machines. 5 types, 25 models. Priced from $107.50, FOB Racine.



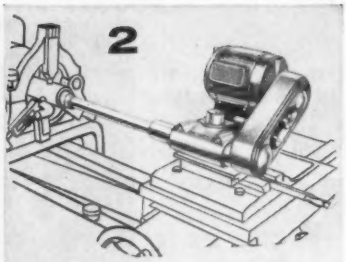
YOUR DUMORE DISTRIBUTOR HAS COMPLETE STOCKS FOR FAST DELIVERY



1

small diameter external grinding

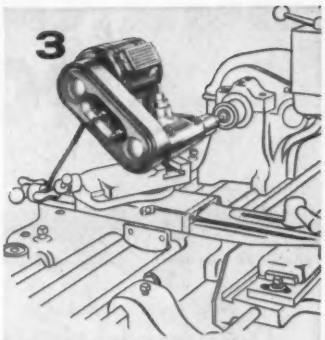
precision to within .0001"



2

deep hole internal grinding

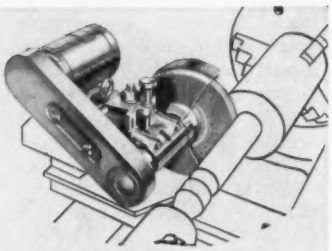
with Dumore internal grinding quills to depths up to 24"



3

small hole internal grinding

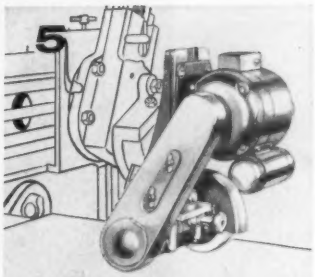
down to 1/8" diameter with mounted wheels or burrs



4

large diameter external grinding

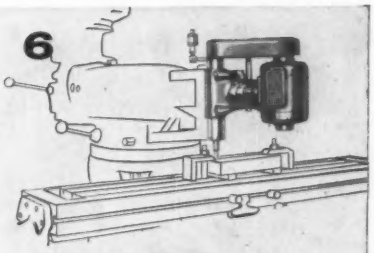
ample power for rapid stock removal; maximum production on big jobs



5

surface grinding

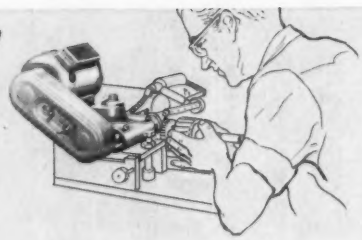
convert planers, shapers, millers to precision surface grinders



6

irregular shapes

grind any contour, shape or radii determined by table travel

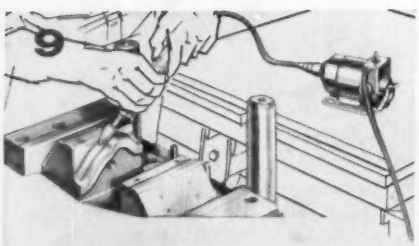


7

single purpose grinding

on the bench or in special set-ups

YOU CAN DO MORE WITH DUMORE® PORTABLE PRECISION METALWORKING TOOLS



9

lightweight working convenience

Dumore Flex-Shaft Tools

10

precision spindles wherever needed

Dumore Precision Quills

THE DUMORE COMPANY

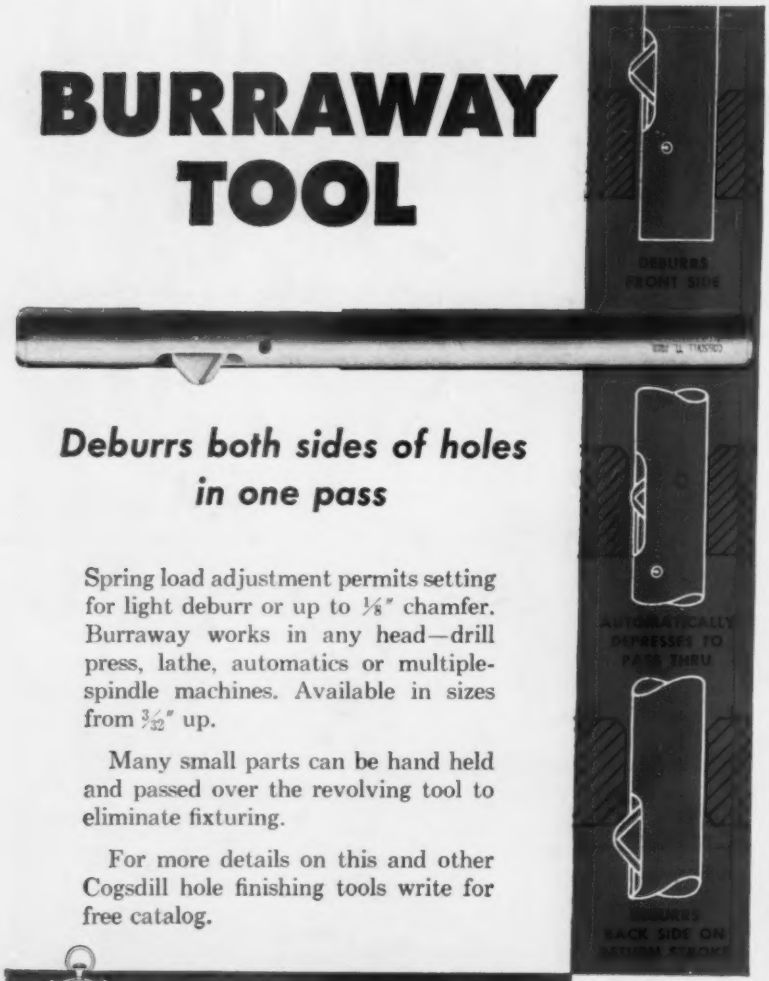
1329 Seventeenth Street
Racine, Wisconsin

HI-SPEED DRILL UNITS • DRILL-N-TAP UNITS
DRILL UNITS • DRILL HEADS • MICRO-DRILLS
DRILL GRINDERS • TOOL POST GRINDERS
HAND GRINDERS • FLEX-SHAFT TOOLS
QUILLS AND ACCESSORIES • VERSA-MIL

When you have a need for erector-type components for special machines... machining heads, feed tables, machine beds... contact our subsidiary Master Manufacturing Company, Hutchinson, Kansas.

...SEE HIM FOR A DEMONSTRATION...OR WRITE FOR BULLETIN G-60-C

BURRAWAY TOOL



Deburrs both sides of holes in one pass

Spring load adjustment permits setting for light deburr or up to ⅛" chamfer. Burraway works in any head—drill press, lathe, automatics or multiple-spindle machines. Available in sizes from 3/32" up.

Many small parts can be hand held and passed over the revolving tool to eliminate fixturing.

For more details on this and other Cogsdill hole finishing tools write for free catalog.

Cogsdill

CIRCLE 397 READER SERVICE CARD

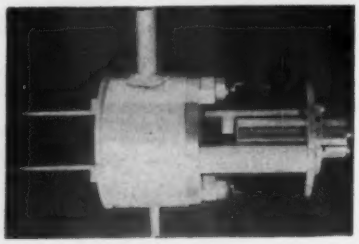
FLI-KUT
New - Improved
FLY-TOOL CUTTER HOLDER

3 convenient sizes with 3/4" shank and stand used with 5/16" carbide or high speed tool bits. Will machine up to 6" wide surface. NEW counterbalanced model allows faster speeds and feeds. Made of steel—hardened. Save on expensive end mills and sharpening cost. Better finishes. Write for Bulletin.

$39.50 SET OF 3

BUY FROM YOUR DEALER

CITY TOOL DIE & MFG. CO., INC.
132 SPENCER AVE., SAN JOSE 10, CALIF.



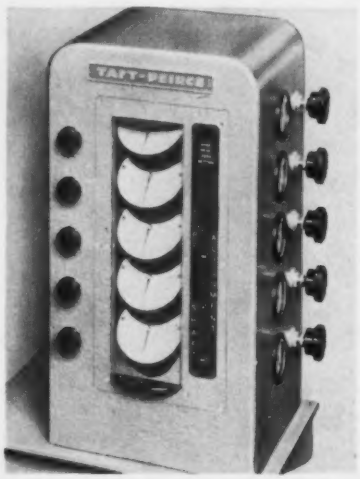
Electron Beam Gun Moves Beam Electrostatically in 3-in. Circle

Designated Model 2025G, this self-accelerated electron beam welding gun for welding refractory and reactive metals incorporates electrostatic deflection for moving the beam within a 3-inch circle. Designed for use with a Model 2025S power supply, the gun can be operated in standard stainless steel bell jars or in larger chambers for production work.

In addition to electrostatic deflection the gun is mechanically moved in the vacuum. It is rated at 20kv, 5 kw and can also be used for evaporation in thin film deposition, button melting, and zone refining.

High Vacuum Equipment Corp, 2 Churchill Rd, Hingham, Mass

MORE DATA? Circle 122, inside back cover



READINGS from 5 different points are shown on dials in a cabinet only 10¼ in. wide. Cabinet for the dials is only 9 in. deep and 18½ in. high. Space saving is achieved by mounting the dials at a 45° angle to the cabinet panel in vertical rows as opposed to horizontal rows used with most multi-dial units. Arrangement also allows full visibility of the entire sweep of the indicator—*Taft Peirce Mfg Co, Woonsocket, RI*

MORE DATA? Circle 123, inside back cover

Modular Profiling...Pattern for Assured Accuracy

Progressive manufacturing methods . . . like *modular profiling* . . . are among the means which enable National Tool Company to pass on the benefits of assured accuracy and faster service to its customers.

By constant improvement of techniques such as this, better products result . . . to meet the increasingly exacting demands of the metalworking industry . . . to provide quality and performance *dependability*.

NATIONAL Tools CLEVELAND

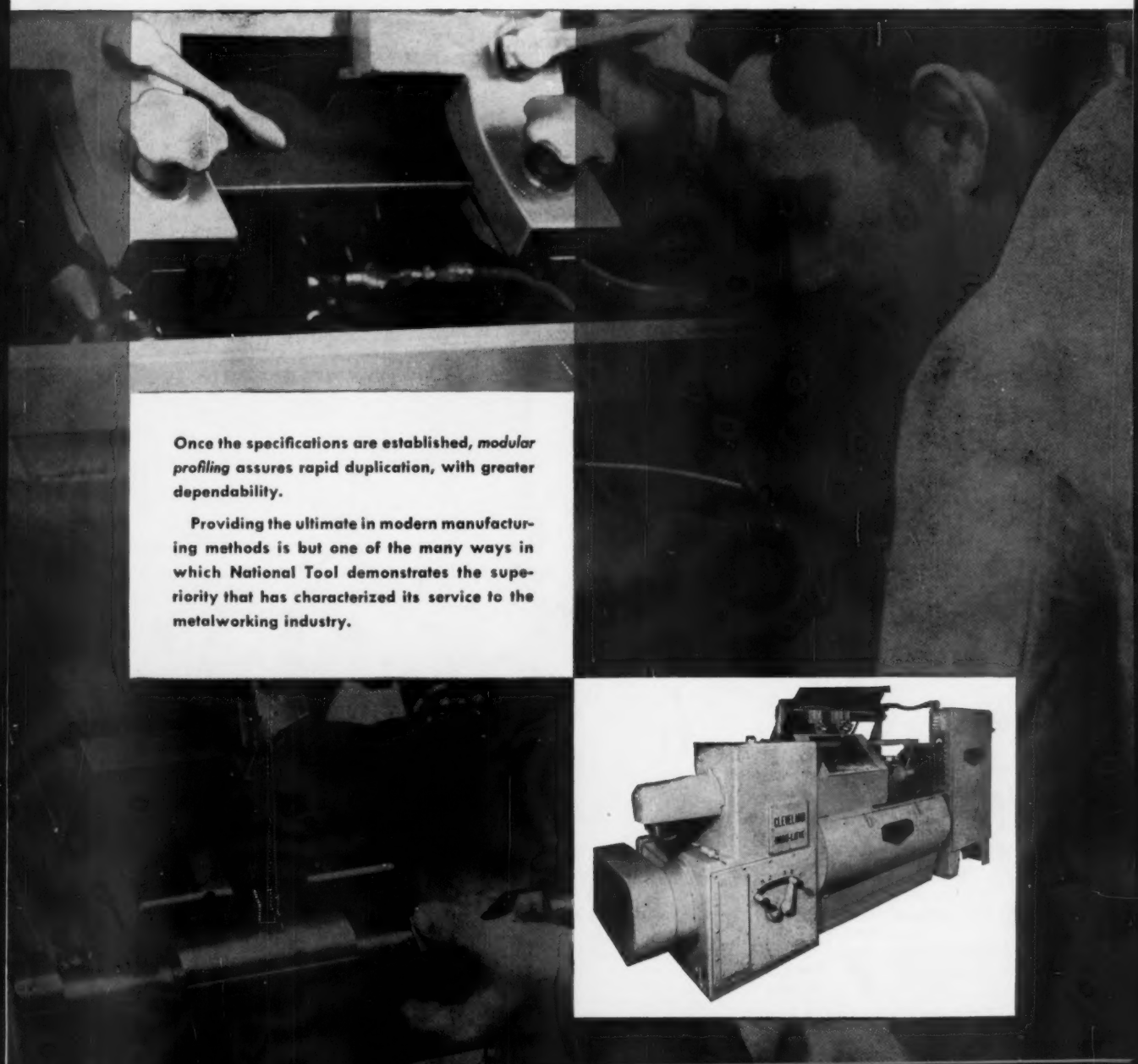
NATIONAL TOOL COMPANY

A DIVISION OF

National Cleveland Corporation, 11200 Madison Avenue, Cleveland, Ohio

For more than a half century National Tool has supplied high quality precision cutting tools to the metalworking industry.

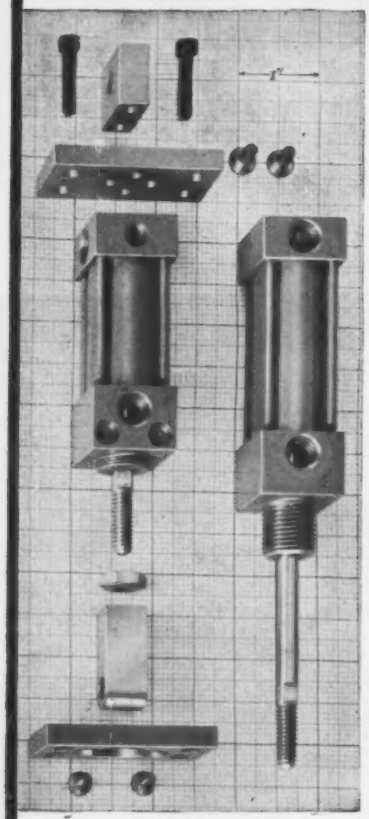
For your special cutting tool requirements call your National Tool representative.



Once the specifications are established, *modular profiling* assures rapid duplication, with greater dependability.

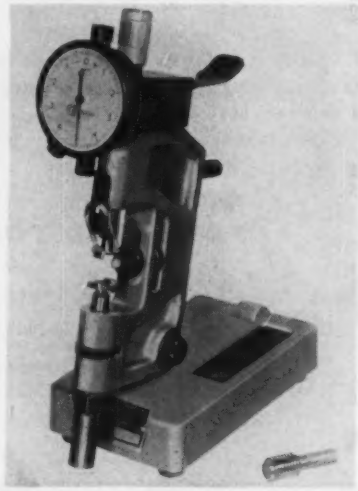
Providing the ultimate in modern manufacturing methods is but one of the many ways in which National Tool demonstrates the superiority that has characterized its service to the metalworking industry.

HOW SMALL
do you want 'em?



Hannifin offers new "Midget-Air" 200 psi cylinders in ¾", 1" and 1½" bores, double-acting or spring-return. Two basic models, "universal" and "nose-mounting." Universal models come drilled and tapped for mounting, or for use with any combination of the mounting attachments pictured. Delivery is off-shelf in standard strokes, shipment in ten days to specified stroke lengths. Want dimensions and prices? Write:

PARKER HANNIFIN CORPORATION
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS
HANNIFIN COMPANY
A DIVISION
517 South Wolf Road • Des Plaines, Illinois
EUROPEAN DIVISION • PARKER-HANNIFIN N.V. SCHIPHOL • THE NETHERLANDS



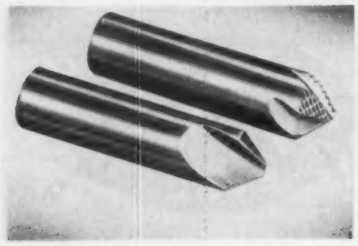
Thread PD Comparator Uses Standard 3-Wire Method

Standard's indicating PD comparator, combined with 3-wire carriers, is reported to provide the fastest, most accurate method of measuring thread pitch diameters with the accepted standard 3-wire method, actually five times faster at 1/6 the cost.

Conventional hand-held wires are placed in individual carriers for greater handling ease and longer life. Available in three sets, N, P, and NQ, they are designed for use on micrometers and measuring machines as well as the comparator. The comparators can also be used to measure gear PDs and regular ODs with a range from 0 to 1-1/16 in.

Standard Gage Co, Poughkeepsie, NY

MORE DATA? Circle 124, inside back cover



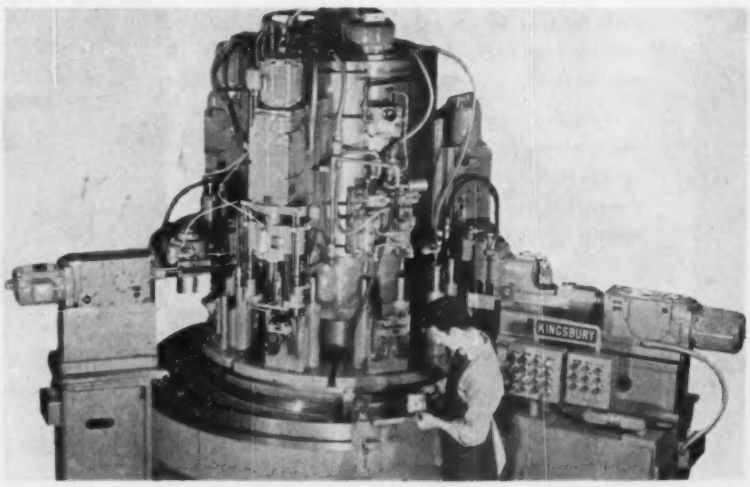
Chamfersink, Countersink Offered By Dixie Tool

Multi-flute chamfersink works in ferrous and non-ferrous materials where chamfering, deburring, or light countersinking is required. Originally designed for countersinking plastics, it will make a clean smooth seat in most plastic materials and will not leave ragged or fuzzy edges. It is available in 60, 82 and 90-degree included angles as standard.

Also introduced is a mono-flute countersink for all metals including the exotic metal types. It is available in the same angles as the chamfersink as standard but can be ordered with any angle as special.

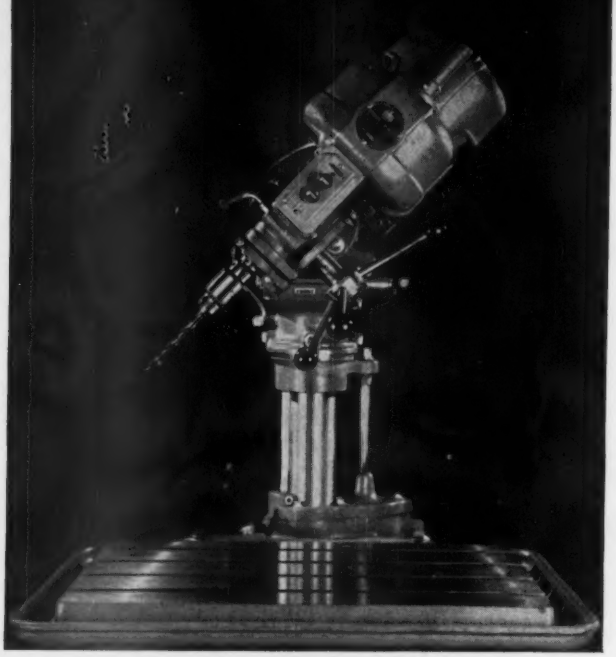
Dixie Tool Industries, Inc, Bridgeport, Mich

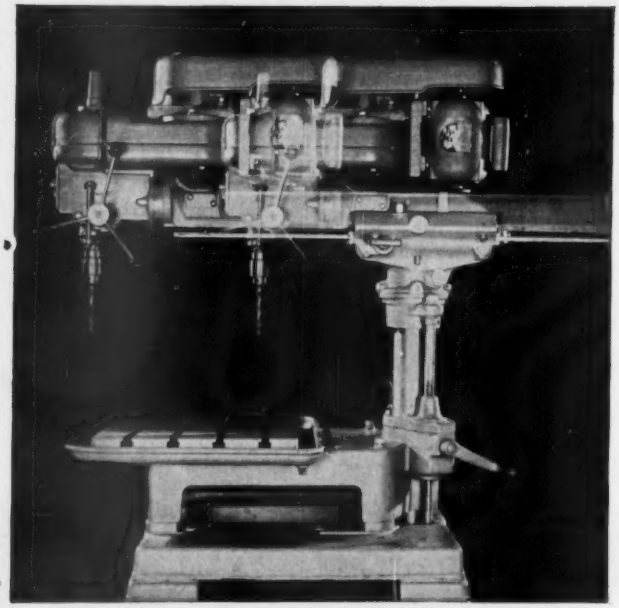
MORE DATA? Circle 125, inside back cover

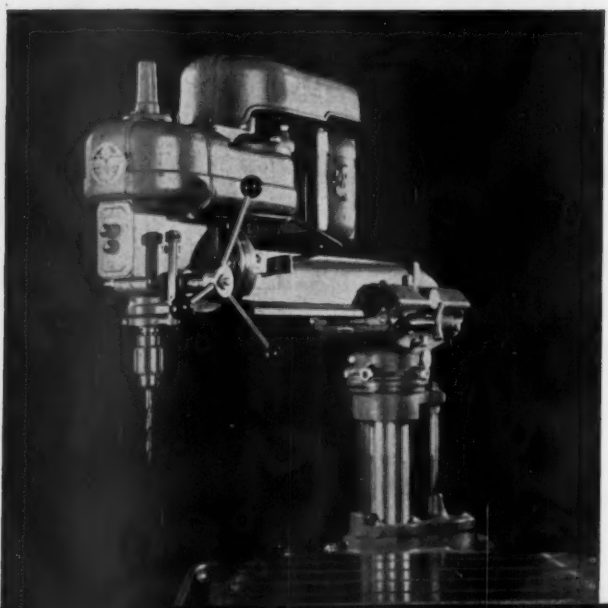


SEVEN UNITS WITH 14 SPINDLES mill, drill, countersink, and tap aluminum valve bodies for automatic transmissions at 300 per hour. A 63-in. index table holds eight work fixtures with power clamping and automatic unclamping. Finish mill for throttle body face rotates at 3600 rpm and gives 50-microin. finish. Vertical unit for finishing holes has mechanical probe to locate broken taps before finish milling—*Kingsbury Machine Tool Corp, Keene, NH*

MORE DATA? Circle 126, inside back cover







Any way you look at it

YOU CAN'T BUY MORE *FLEXIBILITY*

At a low price of $760.00* Walker-Turner "Light-Heavyweight" Radial Drill Presses do the work of machines costing more than twice as much! For fast set-up in drilling of large or heavy stock and to solve special horizontal or vertical drilling problems they offer these important extras: *Extra wide drilling range*—head moves 18" on traveling ram, swivels 360° around column, tilts 45° left or right. *Extra speed versatility*—choice of 15 speeds from as low as 110 rpm to as high as 8300 rpm. *Extra capacity*—drills to center of 62" circle, your choice of 4¼" or 6" spindle travel. But the biggest extra is the extra savings you'll enjoy on fixturing and set-up time when you put this rugged machine to work on your toughest drilling jobs.

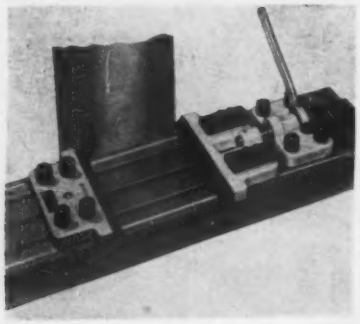
Visit your Walker-Turner Distributor (listed in the Yellow Pages under MACHINE TOOLS or TOOLS). Learn for yourself why more people in metalworking call Walker-Turner the *value* line.

**Model 65-202*

Get information on all 24 models of the W-T Radial Drill Press. Write for FREE Catalog: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WL-21 400 North Lexington Ave., Pittsburgh 8, Pa.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

CIRCLE 401 READER SERVICE CARD



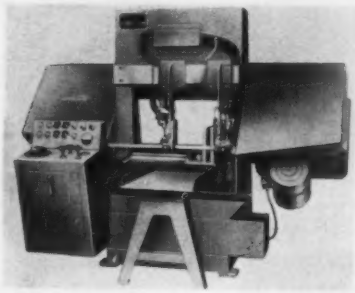
Extension Hold-Down Vise Powered for Heavy Work

Imp extension model is built to hold plates, castings, and parts which are beyond the capacities of standard vises. Entire top surface of the work is free for machining without interference of clamps. Manual effort to tighten the vise is greatly reduced with the aid of the 10-in. ratchet handle together with a roller thrust bearing on the jack screw. Easy to set up, and keyed for self-aligning, this new vise design eliminates the present method of hammering.

Sliding jaw unit has a 1-in. travel, keyed and gibbed to alleviate raising or twisting. Unit is furnished with two types of 1-in.-wide interchangeable hold-down jaws. Jaw mounting permits use of ½-in.-high parallels to raise work for through machining. Optional rising plates are available for high clamping. Vise can be assembled on a baseplate (made to order) for cross mounting.

Illinois Metal Products, 429 W Superior St, Chicago 10, Ill

MORE DATA? Circle 127, inside back cover



Band Saws Allow Operator To Dial Blade Speeds From 40 to 400 fpm

Heavy-duty band saws are produced in two models, both fully hydraulic and automatic and both featuring twin column construction with the cutting head raising and lowering vertically for positive horizontal blade action .Model Q-14 has a cutting capacity of 14 by 18 in. and Model QJ-24, 24 by 24 in.

Controls are located on a stationary panel at the front of the machine and allow an operator to dial desired speeds from 40 to 400 fpm. A 5-hp blade motor powers the blade on both models through gears enclosed in an oil bath. Blade wheels are large size, (20 and 32 in.) for blade flexing and stress and blade guides are carbide, ball bearing type so that no stand-by set or setting gages are needed.

W F Wells & Sons, Inc, Three Rivers, Mich

MORE DATA? Circle 128, inside back cover

Multi-Purpose Drafting Machine Is Tape-Controlled

Model 700 tape-controlled engineering machine for drafting, lofting, scribing, plotting and production tape verification is designed to facilitate total use of mathematical formulas heretofore primarily prepared for use in the processing of control tapes for production machine tools.

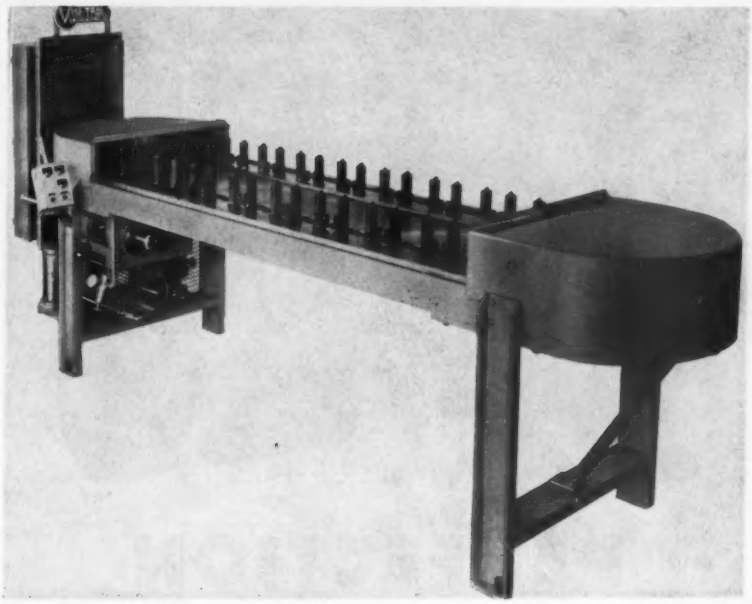
The control system will accept the

coordinate description of an aircraft, missile, or other vehicle component (or a part of any other product, the shape of which can be mathematically defined) prepared and coded on punched tape by a digital computer and peripheral equipment, and the machine will accurately prepare an engineering drawing of such a part or assembly up to 60 x 144 in. in size in a continuous operation. Verification of tapes prepared for use on production machine tools can be made before tapes are released to production, eliminating rejects due to a programming error.

Additional features include manual data input; scale selection for producing drawings 1:4, 1:2, and 2:1; ability to produce mirror image drawings; electronic digital position indicators for simultaneous position readout of both the X and Y axes from drawing zero reference point or machine reference point. Current production models have a drawing area 60 x 144 in. and a line drawing speed of up to 120 ipm. Machine can also be supplied to verify ½-in.-wide magnetic computer tape.

Ekstrom, Carlson & Co, 1400 Railroad Ave, Rockford, Ill

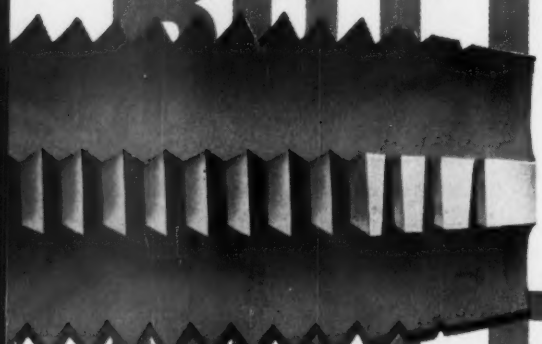
MORE DATA? Circle 129, inside back cover



TRANSFER MACHINE CHASSIS allows progressive assembly and testing of components at rates up to 2000 pieces per hour. Indexing is obtained from a cam and roller index drive plus chain and platen linkage. This permits location of fixtures in the 26 platens within 0.010 in. Optional features include selection of index and dwell rates, full-length cam shaft, ground tooling plate and automatic lubrication. The machines are available in 10 to 50 ft lengths—*Visi-Trol Engineering, 12720 Burt Rd, Detroit 23, Mich*

MORE DATA? Circle 130, inside back cover

BUTTERFIELD
BUTTERFIELD

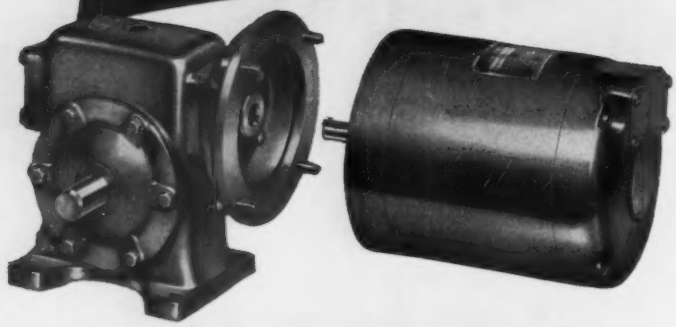


Like all tools in the complete Butterfield line, Butterfield taps are noted for precision performance, long life, and high value as production tools — not only when used individually but with other taps or cutting tools. Get these production benefits . . . through prompt deliveries and trained technical service in your machining operations . . . Call your Butterfield Distributor. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

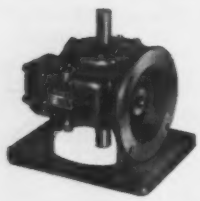
BUTTERFIELD
BUTTERFIELD

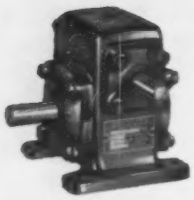
Division, Union Twist Drill Company, Derby Line, Vt.

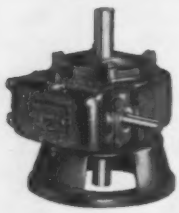
Precision Engineered-
Performance Tested



PERFECTION
Worm Gear
SPEED REDUCERS





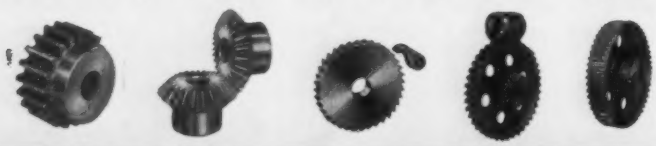


One of our major capabilities is to design, develop and produce speed reducers that will insure maximum performance and economy in your operation. Our experience in the special problems and objectives of power transmission is broad and deep. The men at American Stock Gear having this important capability, use the most advanced analytical engineering facilities to design speed reducers to meet tomorrows needs.

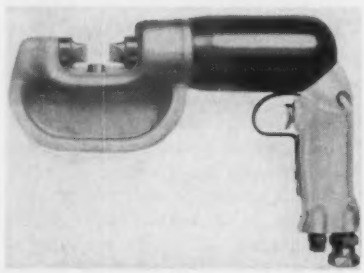
Whatever size or style reducer you need, you'll find the right combination in the complete Perfection line — a line that is precision engineered and performance tested in thousands of different applications.

If you have a reducer problem that you feel is "different", our engineers are ready to advise, design and produce speed reducers to your particular requirements. In the meantime, write for your copy of our Reducer catalog containing illustrations, charts and tables to help you on your next application.

We make a complete line of stock gears. Send for Gear catalog No. 360.



AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY, HARVEY, ILLINOIS



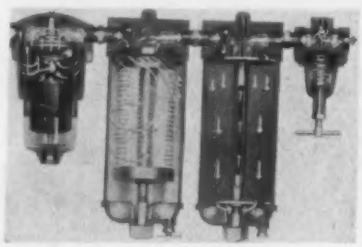
Portable Power Tool Delivers Up to 27-½ tons Cutting Power

Pneudraulic Rod Cutters, designed for snipping reinforcing bars, alloy steel rods and bolts up to 1-in.-dia, are powered by a remotely controlled portable power cell about the size of a cannister-type home vacuum cleaner. This cell, mounted on casters and light enough to be carried anywhere, converts normal shop air pressure into hydraulic pressure up to 7000 psi.

The tool, compactly designed for close-quarter operations, has a movable handle which can be mounted at right angles to the cylinder or in line with it. Three sizes are available. The smallest, weighing 10½ lb, delivers 12 tons of cutting force.

Chicago Pneumatic Tool Co, 6 East 44th St, New York 17, NY

MORE DATA? Circle 131, inside back cover



Multi-Unit Package Speeds Compressed Air Cleanup

Compressed air dehydrator package for drying air and ridding it of oil and dirt contaminants is available as shown or can be purchased with any one of the units omitted or other special units added.

Rated at a maximum of 10 cfm at 100 psi, the unit can lower the dewpiint of air to—100 F and reduce oil content to 2 ppm. Draining is not required since the first stage of the unit has a moisture separator with built-in automatic sump drain mechanism. Second stage of the unit is a filter that removes dirt as small as 3 microns in size, plus oil fumes. Following this is a stage for lowering the oil or moisture dewpoint.

A regulator on the outlet controls the air pressure. No electrical or water connections are necessary. The entire desiccant is visible in the dehydrator through its transparent shell, indicating need for reactivating or replacement.

Wilkerson Corp, 1671 W Mansfield, Englewood, Colo

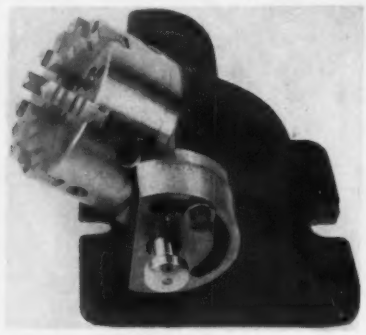
MORE DATA? Circle 132, inside back cover

Bendix Offers Lifetime Warranty On Omnimite Transducers

Omnimite, a magnetostrictive transducer, metallically bonded to a ¼-in.-thick 316-L stainless steel diaphragm, is used in a new series of Bendix sonic energy cleaning systems. Every Omnimite transducer diaphragm assembly is guaranteed unconditionally not to break, crack, depolarize, deteriorate, become detached, or in any way cease to function for the lifetime of the cleaning unit.

Bendix Corp, Pioneer-Central Div, Sonic Energy Products, Davenport, Iowa

MORE DATA? Circle 133, inside back cover



Universal Indexer Has 6-in. Swing

This new universal indexer takes either a Buck 4-in. chuck or standard 5C collets. Suitable for toolrooms as well as production lines, it can be used in drilling, milling, and grinding operations as well for layout and locating angles.

Features include facilities for quick interchange of chuck or collet; head can be angled from –0 to 90° +. Spindle rotates 360° and can be quickly indexed and locked in positive position by a spring loaded pin against a spacer indexing ring, available with a variety of location combinations. A 24-position space ring is included with the standard unit; other spacer rings are available for numerous combinations.

Kalamazoo Industries Inc, Box 2558, Kalamazoo, Mich

MORE DATA? Circle 134, inside back cover

trim the cost of trim painting!

fast and fancy finishing when you use masking

TAPES FROM 3M

The Harley-Davidson Motor Co. chooses masking tapes from 3M to speed much of the decorative trim painting on their products. Curved surfaces . . . complicated designs . . . the need for perfect results make "Scotch" Brand Masking Tapes especially desirable. These tapes from 3M conform easily . . . stick at a touch . . . remove cleanly and easily . . . leave no adhesive residue.

TRY THIS METHOD. See how it speeds finishing operations and improves results. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. IBA-111.

SCOTCH BRAND tapes for industry

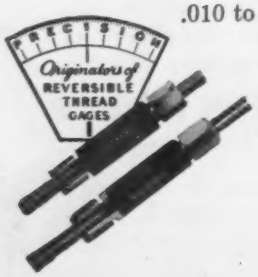
Minnesota Mining and Manufacturing Company

. . . where research is the key to tomorrow

3M COMPANY

"Scotch" is a registered trademark of 3M Co., St. Paul 6, Minn.

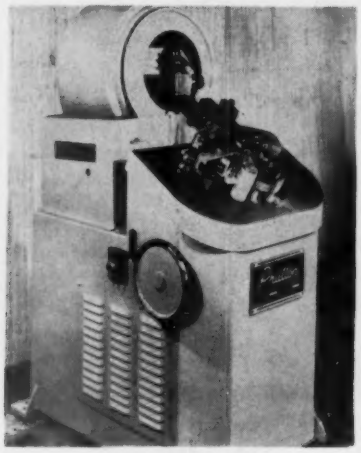
Precise as a diamond cutter . . . the Centerless Lapper by Size Control Co. will finish the hardest of CARBIDES easily. . . . . By impregnating diamond compound into the rolls, parts made of carbide can be lapped into close tolerance with no effort and no waste! Ideal for the small tool shop as well as large manufacturers as it is ready to go to work on a wide variety of jobs. No special set-up is needed. A simple adjustment varies the space between the rolls permitting lapping any diameter from .010 to 6" in a minimum amount of time. Write for additional information.



SIZE CONTROL COMPANY

2500 W. Washington Boulevard
CHICAGO 12, ILLINOIS • MOnroe 6-6710

Area Code 312
Division of American Gage & Machine Company

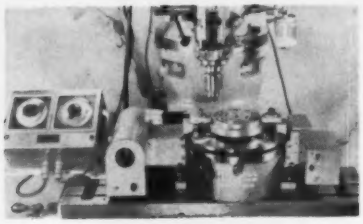


Prutton Threadrolling Machine Threads Screws, Nails at 400/Min

Prutton Model 75 threadrolling machine thread rolls screws and nails at speeds of 400 pieces per minute. The machine handles over-all blank lengths up to 3 in. and diameters as large as ¼ in. Special features include: rear loading during operation, cradled hopper with external drive free of obstructions, track-mounted vibrator, rapid adjusting feed track, and a small thin-wall ring die that can reportedly be set up in ten minutes to perfect concentricity.

Prutton Corp, 5305 W 130 St, Cleveland 30, Ohio

MORE DATA? Circle 135, inisde back cover



Electronic Index Table Gives Automatic Spacing to 0.10 Degree

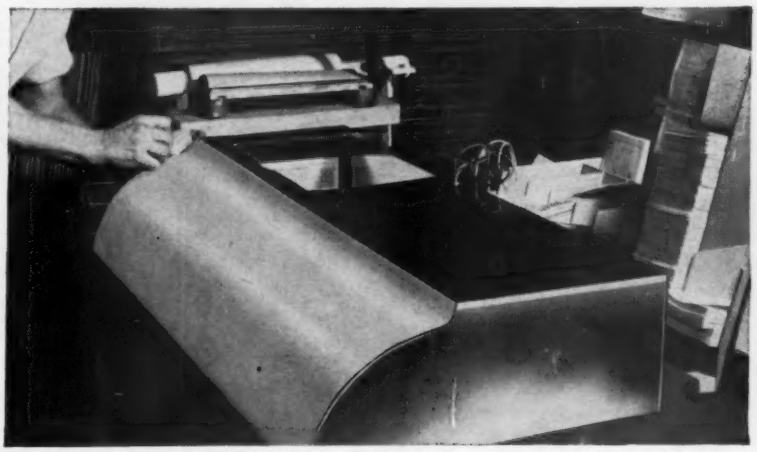
Designed for automatic spacing of hole patterns in 1, ½, and or 1/10 degree increments, the MM 800 electronic index table can also be used for programming a part that must have slots milled in it.

With a 15-in program plate the table can program uneven indexes and for all indexing the MM 800 can be used in a vertical or horizontal position. It is powered by a 110-volt, 60-cycle motor and has a special slip clutch for hand operation.

M & M Tool & Mfg Co, 1124 E Third St, Dayton, Ohio

MORE DATA? Circle 136, inside back cover

from die to delivery with no repolishing!



metal formed without a scratch when covered with protective

TAPES FROM 3M

Now you can stamp, blank or fabricate highly polished metals by first covering the area to be worked with "Scotch" Brand Protective Tape. Even light draws may be made without die-marking the finished surface. Nor is repolishing necessary. On most products, the tape can even stay-put up to point of use.

TRY THIS METHOD. See for yourself how "Scotch" Brand Protective Tapes save both time and rejects in your plant. Ask your nearest "Scotch" Brand Tape Distributor to show you how, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn. Dept. IBA-111.

SCOTCH BRAND tapes for industry

Minnesota Mining and Manufacturing Company

...where research is the key to tomorrow

3M COMPANY

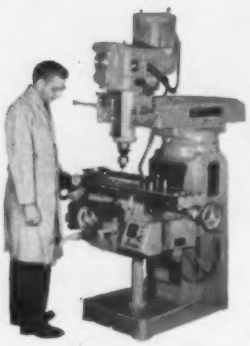
"Scotch" is a registered trademark of 3M Co., St. Paul 6, Minn.

GREATEST SPEED RANGE

IN VERTICAL MILLING
65 to 4600 RPM

New GORTON VARIABLE SPEED HEAD Model 1-22 Mastermil

- The ideal head for milling high tensile strength alloys with maximum cutter efficiency.
- Remarkably smooth spindle operation throughout entire speed range from 65 to 4,600 RPM . . . insured by *unison-mechanical* change of pulley diameters, with positive control.
- Guaranteed high precision spindle of interchangeable self-contained design.
- Direct reading spindle speed dial provides fast speed selections.
- Maximum torque in low speeds through back gear design.
- Dial-type down feed—infinitely variable .250 to 4.000 inches per minute with built-in over-running clutch for feeding against positive stop.
- Traditional GORTON quality in every detail.



Write for Bulletin No. 2699 for complete description of new variable speed head and Gorton Mastermil.

A Gorton Product, the Finest of its Kind!

GORTON
SINCE 1893

GEORGE GORTON MACHINE CO.
1511 RACINE STREET, RACINE, WISCONSIN

Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems.
Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories... Defense and special products.

Compact Low-Cost Arc Welder Delivers up to 225 Amps

Compact all-purpose arc welder is said to be the lowest cost 225-amp unit on the market. Selling for $159.50, the Model 225-W is designed for a 230 v ac input and has a current output from 30 to 225 amps. It will operate with any ac electrode including low-hydrogen and stainless steel in sizes up to 3/16 in. Duty cycle of the machine in arc-welding is 20% and it can also be used as a power supply for spot-welding guns which are available at extra cost.

Bren Weld Corp, 5114 Third Ave, Brooklyn 20, NY

MORE DATA? Circle 137, inside back cover

Index Unit Has Torque Range Of 25,000 in.-lb

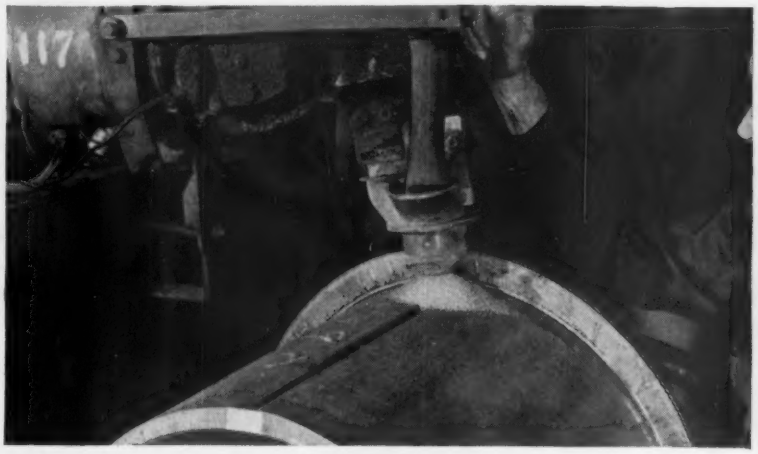
Indexing drive unit is designed for adaptation to cycling precision conveyors, transfer chassis, and dial indexing machines. Internal cams provide indexing accuracy within 0.001 in. on a 12-in.-dia sprocket or dial.

Standardized drives are available with a wide selection of output shaft angular movements from four to 24 stops. Indexing periods are available in 90°, 120°, 180°, and 270° to permit selective cycle timing of index and dwell.

Visi-Trol Engrg Co, 12720 Burt Rd, Detroit 23, Mich

MORE DATA? Circle 138, inside back cover

flux stays put...
air stays out!



smoother welds every time when back-up tool is glass cloth

TAPES FROM 3M

As a back-up material in submerged arc welding operations, "Scotch" Brand Glass Cloth Tape holds flux in . . . keeps unwanted air out. Tape adheres instantly to underside of girth or longitudinal seams for butt, double V and fillet type welds. Its use overcomes need for expensive jigging or other cumbersome back-up methods used to prevent burnout.

TRY THIS METHOD. See how it minimizes your flux waste and clean-up costs. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn. Dept. IBA-111.

SCOTCH BRAND
tapes for industry

Minnesota Mining and Manufacturing Company
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3M COMPANY

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.

COLD FINISHED STEEL BARS PROVIDE THE

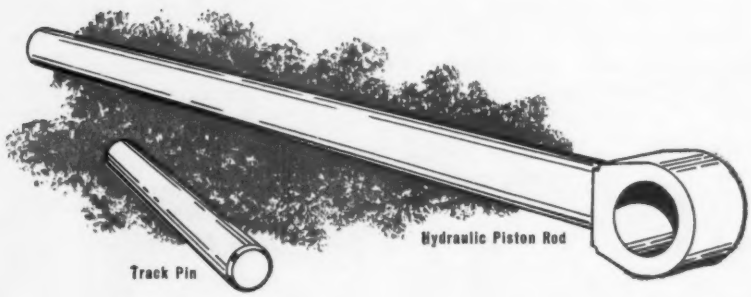
MIGHTY MUSCLES FOR AMERICA'S MOBILITY

America can't move without cold finished steel bars. Every automobile, truck, train, airplane and the equipment that builds the arteries on which they travel, depends on cold finished steel bars.

Take this rugged front-end loader. The hydraulic piston rods—the muscles through which tremendous power surges—are made from the finest cold finished steel bars produced by Bliss & Laughlin. Turned, Ground and Polished bars, precision-made, chrome-plated, strong, hard, straight, free of nicks and scratches, assure a tight, flowing fit against cylinder packings.

Scores of pins made of strong and dependable Bliss & Laughlin cold finished steel bars join crawler track units. Control rods, fittings, fasteners, shafts and studs, among other components, employ various types of Bliss & Laughlin steel bars.

For over 70 years, Bliss & Laughlin has been supplying cold finished steel bars to keep America on the move. Producing the industry's most extensive line of cold finished steels, seven mills across America, collaborating with Steel Service Centers everywhere, assure prompt, helpful, local service.



The chrome plated hydraulic piston rods may be produced from Turned, Ground and Polished C-1144 Strain-Tempered,® C-1045 Lusterized, carbon restored, induction hardened, or alloy grades. The track pins illustrate another type of analysis —C-1050 Lusterized, which may be carbon restored and induction hardened. Bliss & Laughlin can always furnish the most suitable steel for your field service and machining requirements.

BL-619

Leading Independent Producer of Cold Finished Steel Bars

BLISS & LAUGHLIN

GENERAL OFFICES: Harvey, Ill. **MILLS: Harvey, Ill., Detroit, Cleveland, Buffalo, Mansfield, Mass., Los Angeles, Seattle**

CIRCLE 411 READER SERVICE CARD

HOW KAISER BENDS ALUMINUM CONDUIT ELBOWS...at low cost!

Low-cost volume forming of conduit elbows by the Kaiser Aluminum & Chemical Corporation at their Dolton, Illinois, plant has been important to their attainment of a leading position in the production of aluminum electrical conduit. Conduit and elbows are produced in 13 standard sizes ranging from ½" to 6" I.P.S. A single, versatile Pines Model 3 Bending Machine handles the ten standard conduit sizes from ½" to 4" . . . producing smooth 90° elbows with speed and accuracy.

The conduit elbows are bent without the use of mandrels, keeping tool costs low. Even without mandrels, there is no distortion of pre-threaded ends and flattening is held well within the limits set up by the Underwriters Laboratories Code. Production of smaller size elbows is increased up to 75% by bending two at a time on stacked tools.

Find out now how the speed and versatility of Pines Bending Machines can help you produce better quality products that cost less.

WRITE TODAY FOR COMPLETE CATALOG AND CASE STUDY REPORTS

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

672 WALNUT ST. • AURORA, ILL.

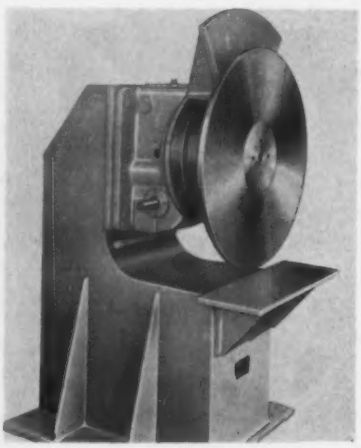
Filtration Equipment Offered For Water Soluble Coolants

Filtration system, developed by Braithwaite Equipment Ltd, England, and now manufactured in the US, is designed for removal of contaminants from machine tool coolants.

Model PF-3-6-1 is a complete coolant filtration unit with reservoir tank and means for adapting a conventional coolant pump. Model PF-3-1 is a coolant filtration arranged with abrasive circulator and filter cage. Clean coolant is discharged to the right or left, through the lower flexible hose to machine reservoir tank. Both models will filter 30 gal of coolant per minute of all particles over 5 microns. Capacities up to 1200 gpm are available by adapting a series of filtration cages and larger capacity abrasive circulators.

Pressurized Filtration Inc, 6910 Chase Rd, Dearborn, Mich

MORE DATA? Circle 139, inside back cover



Turret Indexing Machine Chassis Has Vertical Indexing Table

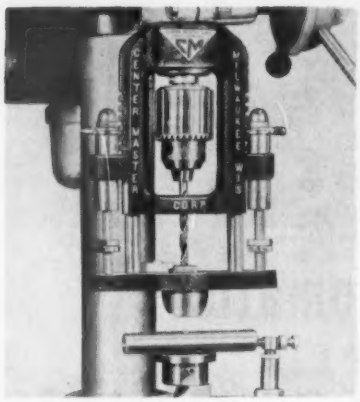
New vertical turret chassis, a modification of the standard Series B chassis, employs a hardened tool steel

cross-over indexing cam that provides a cycloidal dia-placement cam path. Main index camshaft extensions provide for mounting operational cams to actuate tooling mounting cams for electrical initiation of tooling sequences, and for actuating auxiliary camshafts for additional tool motions. This unit is suitable for many types of assembling, processing, or testing operations requiring positive mechanically actuated intermittent motion in a vertical plane.

Chassis, available with 20, 30, or 40-in. turret, is completely self-contained, including motor and mechanical drive components, and is offered in a wide range of index positions and work cycles to facilitate their application in special-purpose automatic machines.

Swanson-Erie Corp, 814E Eighth St, Erie, Pa

MORE DATA? Circle 140, inside back cover



Drillpress Attachement Adapts To Quill of Any ½-in. Drill

The Center Master attachment can hold, locate, and guide the cutting tool on any round, hexagon, or square part. Unit is easily attached to the quill of any ½-in. drillpress.

The drillpress chuck is located in the center of the unit frame. Drill, reamer, or counterbore passes down through a bell bushing or V-bushing, depending on type of work. A 100-lb spring pressure on push-rods holds the work securely in place; adjustable stops control the cut depth and the unit is also adjustable for various diameters or stock sizes. Drill jigs or special holding fixtures are eliminated in most cases. The unit can be set up for burr or nib cutoff, off-center drilling, and special drilling with V- bushings.

Portage Double Quick Inc, 1026 Sweitzer Ave, Akron 11, Ohio

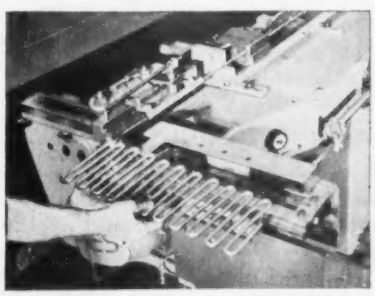
MORE DATA? Circle 141, inside back cover

IF YOU MAKE PARTS LIKE THESE...

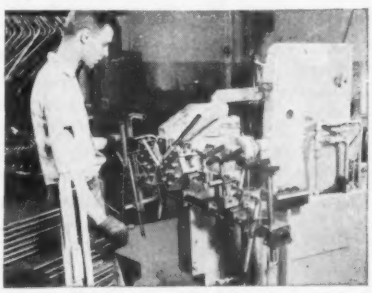
YOU CAN SAVE BY BENDING!

By production bending the "Pines-way," hundreds of metalworking plants are now benefiting from the cost-cutting advantages of cold-bending tubing, pipe, extruded or rolled shapes into parts similar to those above. Parts are produced faster, with smooth, strong bends. This means improved product quality at reduced costs.

A wide range of bending on large or small work, long- or short-run jobs, is easily accomplished by a complete line of standard Pines Bending Machines. Hydraulic power and automatic operation provide maximum accuracy, efficiency, and economy. Find out today, without obligation, how these machines can produce your parts at less cost.



Serpentine coil formed on Pines Rotary Machine at 900 bends an hour with 8% material savings, reduced assembly costs.



Tubular steel furniture frame is produced on a Pines Bending Press at the exceptional rate of over 2000 bends an hour.

WRITE TODAY FOR CATALOG AND DATA SHEETS

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

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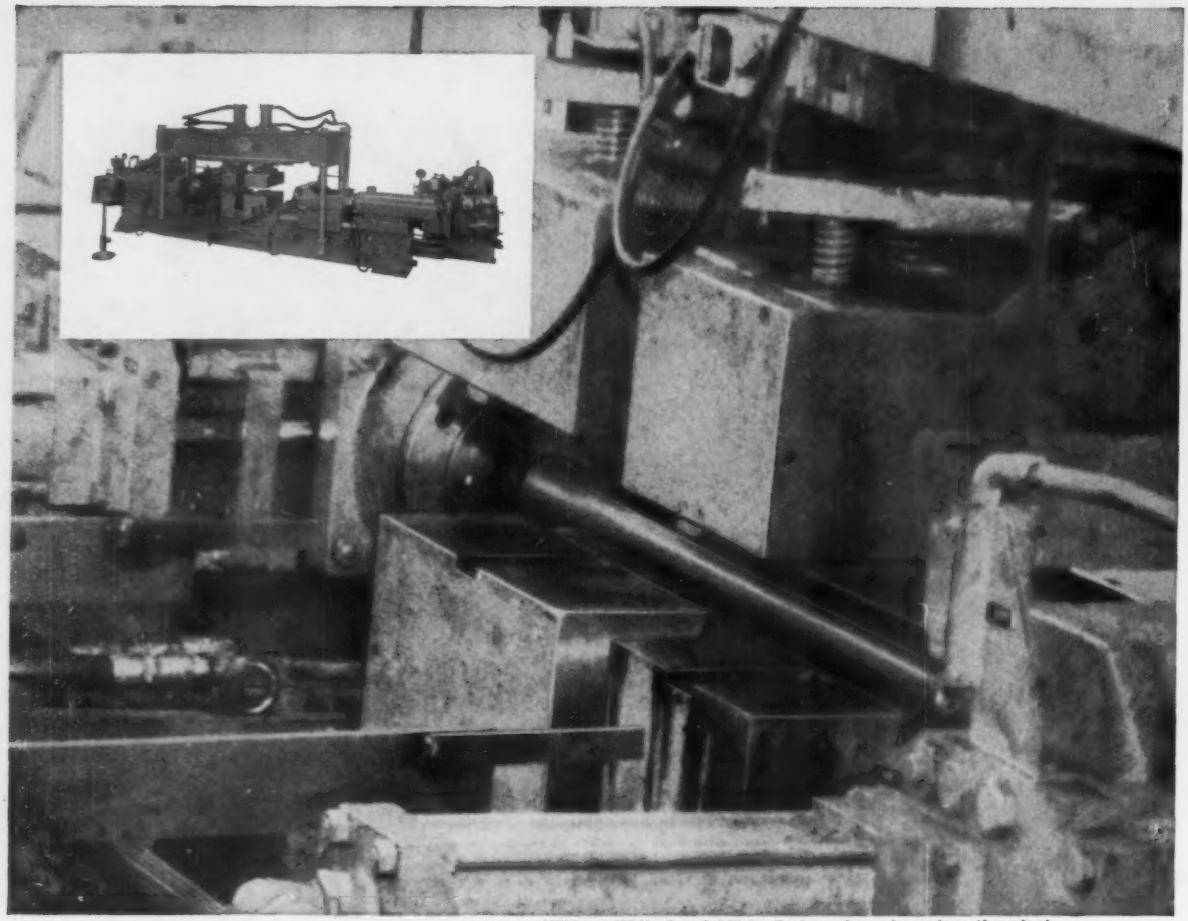

Williams-White Special Tube Reducer in major automotive plant.

Custom Designed--Fully automatic Williams-White TUBE REDUCER

PROBLEM: Design a machine capable of handling torque tubes to 5½" in diameter with a single or double *reduction* or *expansion* operation for *either* or *both* tube ends.

Williams-White engineers tackled this problem, applying the engineering knowledge gained in designing many similar pieces of metal-forming equipment. Double, hydraulically actuated, sliding die heads at each end proved to be the most practical solution for a compact, high-production machine. With this design, position No. 1 may be used for the first pass on a double reduction cycle and position No. 2 for the second pass. Where only one pass is required, production is doubled by completing two parts at each pass.

Williams-White's Special Horizontal Tube Reducer will complete one cycle every 7 seconds using a 6" stroke of the die heads. Maximum production rates are maintained by the utilization of fully automatic loading and unloading equipment.

An example of the wide scope of design and manufacturing capabilities at Williams-White, this special machine illustrates the practical application of engineering know-how gained through the building of metal forming equipment for more than a century. Discuss all of your metal forming applications with experienced W-W engineers.

WILLIAMS-WHITE & CO 600 Third Avenue, Moline, Ill.

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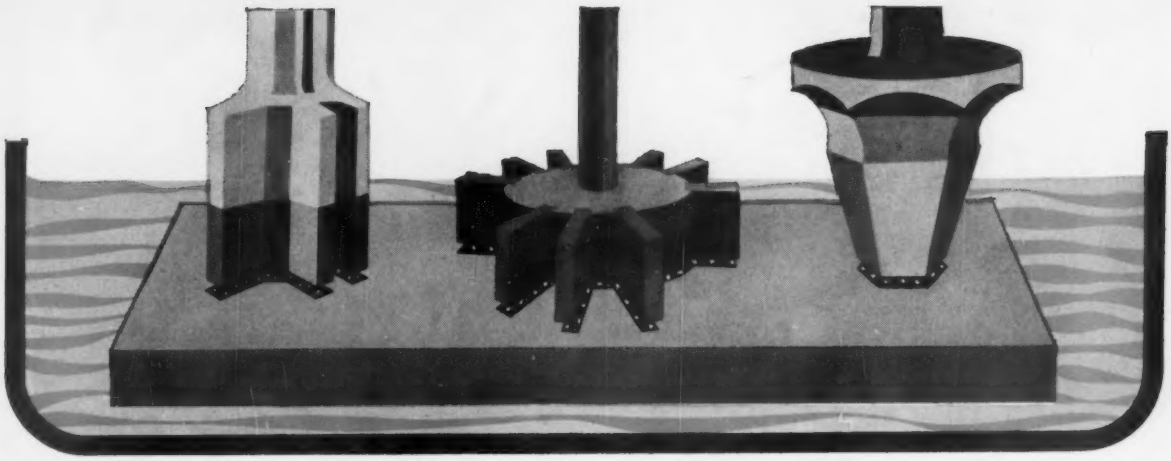

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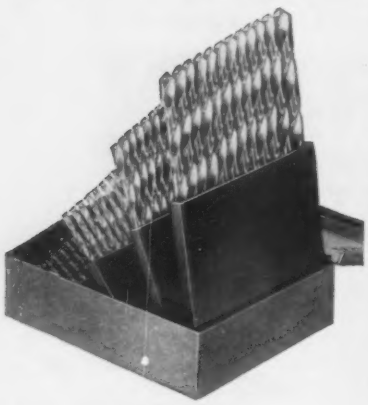

ACE DRILL SETS

Standard stock sets include Fractional, Wire and Letter size drills, packaged in convenient folding index cases.

ACE BLANK SETS

Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits available in standard Fractional, Wire and Letter series sets.

Call your local distributor today—or write Ace direct for latest catalog and price information.

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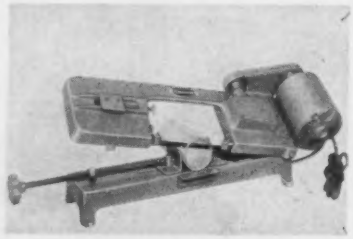
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS



Portable Bandsaw Has Accuracies Within 0.005 in. on 3-in. Cut

The Little G horizontal metalcutting bandsaw weighs 42 lb, including ½-hp motor. It uses a standard ½ x 0.020 x 59-in. blade with accuracies within 0.005 in. on a 3-in. cut. Rectangular capacity is 3½ x 6 in., diameters to 3½ in., and angle cuts to 45° on sizes up to 3½ x 3 in.

Cutting is automatic after the material is clamped into the positive-action vise. Cutting assembly is counterbalanced, eliminating need for hydraulic feed control. Automatic shut-off switch stops the motor when cut is completed. The 7-in.-dia pulleys and blade guides and adjustable takeup minimize blade breakage. Front bed extension is provided for facing operations. Bed size is 7 x 25¼ in.

Griscer Industries Inc, Garrett,

MORE DATA? Circle 142, inside back cover

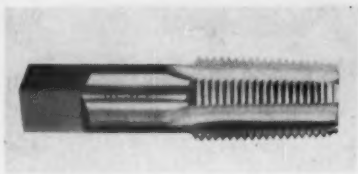
Drill Bushing Tips Aid Mounting Of Machining Units on a Jig

New Taper-Lok drill bushing tips and accessories provide a fast, accurate method for portable or stationary mounting of drilling, tapping, and other self-contained machining units on a jig or fixture.

The threaded end of the bushing tip screws into the nosepiece of the drilling unit. Flanges on the tip fit under the shoulders of lockscrews or lock strips on the jig, holding the drilling unit in alignment position and absorbing both the thrust and torque of drilling.

American Drill Bushing Co, 5107 Pacific Blvd, Los Angeles 58, Calif

MORE DATA? Circle 143, inside back cover



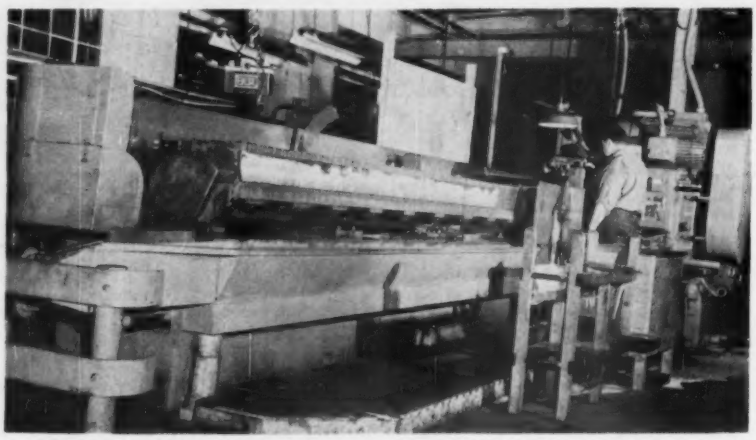
New Besly Pipe Taps Minimize Stop Lines

Line of taper pipe taps incorporates changes in flute geometry and special cam grinding of the thread form. They will thread most metals with absolutely minimized stop lines.

These taps are said to produce an accurate thread which assures pressure-tight joints for critical pipe fitting installations. The tool is reported to maintain uniform cutting action and tests show that it has longer life than taps previously used for this purpose.

Besly-Welles Corp, South Beloit, Ill

MORE DATA? Circle 144, inside back cover



HEAVY DUTY GRINDER installed at John W Bolton & Sons handles extremely thin knives up to 180 in. long. Custom grinder chuck is reportedly the first magnetic chuck mounted on trunnions or pins with precision bearings and is said to assure tolerances of 0.001 in. for grinding in any position or angle. 75-hp grinder uses a 32-in. wheel and is capable of giving a finish of 16 microinches or better—*Hanchett Mfg Co, Big Rapids, Mich*

MORE DATA? Circle 145, inside back cover

A cylinder doesn't think but you do—and when you turn your thoughts to how a machine can perform, a lot of things can happen.

The cylinder responds instantly when activated, and does exactly what you tell it to do with pre-set adjustments. You can synchronize it with the motion of related machines or attach it to a moving machine.

It will produce almost any kind of motion—and do so *without the use of complex mechanical contrivances!*

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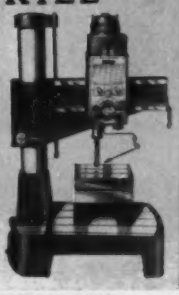
Twelve-speed (46-2190) pre-selection drive. Forced lubrication. Mechanical brake. Automatic depth stop and drill ejector. No. 4 Morse Taper. 6 feeds (.002"-.014"). Hardened steel gears run in oil. Complete—no extras to buy.



SIZE	DRILLING CAPACITY STEEL	DRILLING CAPACITY CAST IRON	PRICE F.O.B. TOLEDO
8" x 30"	1"	1¾"	$2975.00
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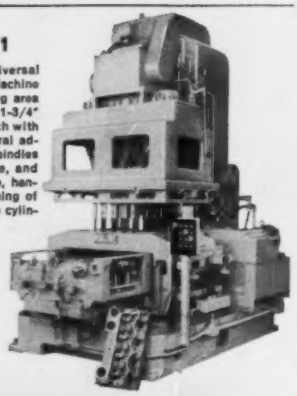
CIRCLE 418 READER SERVICE CARD

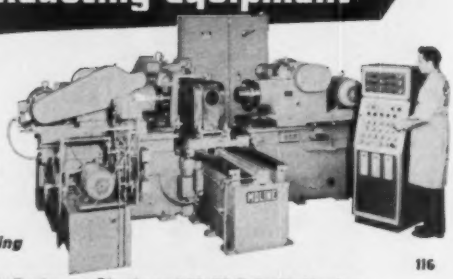
HD13
straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

MODEL HU111
Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



MOLINE Cost Reducing Equipment

MODEL MR148
Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.



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116

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NEW SHOP EQUIPMENT

Copying Tool Engineered To Insure Rigidity

Coromant T-Max disposable insert tracer tool has built-in design features to enable the insert to withstand severest copying forces in all directions without moving. Shape of the top surface of the insert provides angle locking; the clamp locks with a solid wedging effect into the V formed by the inclined surface of the insert and the back of the chipbreaker.

Rhomboidal shape of the insert permits a 40% greater depth of cut and it is also better supported. When properly equated, the insert in its holder reportedly has 2.23 times greater resistance to turning forces than the conventional rhombic (diamond) insert in its holder.

Sandvik Steel Inc, Fair Lawn, NJ

MORE DATA? Circle 146, inside back cover

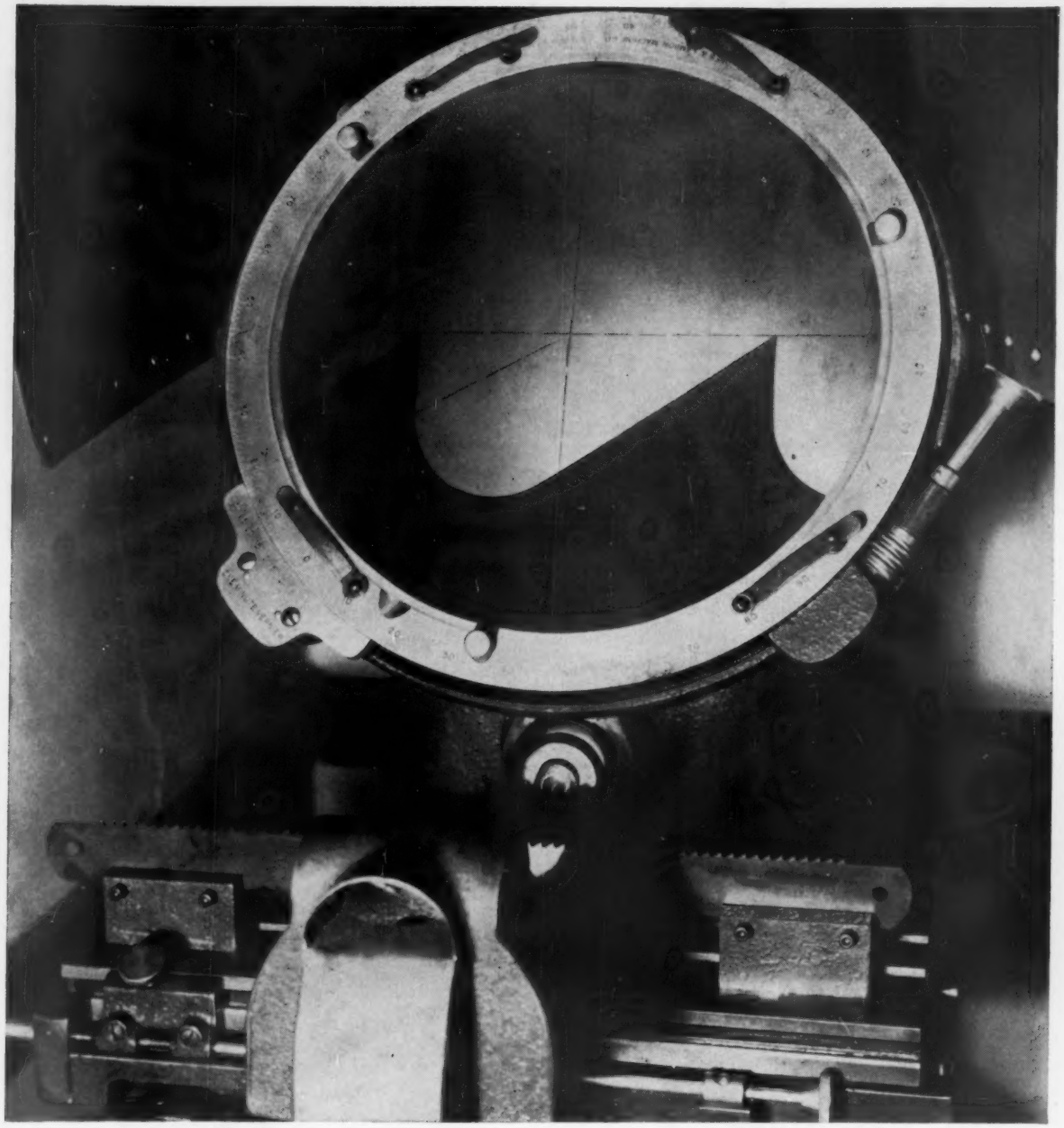
Drillpress Introduced For Micro-Miniature Work

The P&H Drillpress, Model 204E, drills holes from ⅛ in. down to the smallest drill size available. Design features reportedly make it possible to drill holes of this size rounder and straighter than with any other equipment known to be available.

The unit is said to provide an unusually high level of control over maintaining tolerances, prevention of work hardening in materials, and avoiding bell-mouthed holes. This is achieved through combined use of a depth-of-hole indicator and a foot-operated switch-rheostat for speed control, together with the operator's sense of touch on the drill arbor. Principal factor in accuracy is the high degree of squareness between the spindle and its base, within 0.0001 in. per in., which is built-in and permanent.

Raymond Atchley Inc, Div of American Brake Shoe Co, 2339 Cotner Ave, Los Angeles 64, Calif •

MORE DATA? Circle 147, inside back cover



CAN YOUR SAW BLADE PASS THIS TEST?

The best way to test the superiority of a Nicholson or Black Diamond blade is, of course, use. Fit one into your saw and try it. You'll know. It's the finest blade made.

But—one of the reasons for that superb performance is the Micro-Photo Quality Control Test (above). It permits constant checks on tooth formation, cant and degree of coarseness in Nicholson and Black Diamond hand hacksaw, power hacksaw and band saw blades.

Can your saw blade pass this test? It can if it wears the Nicholson or Black Diamond name.*

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Gentlemen: Please send me a free copy of your book, "Sawology."

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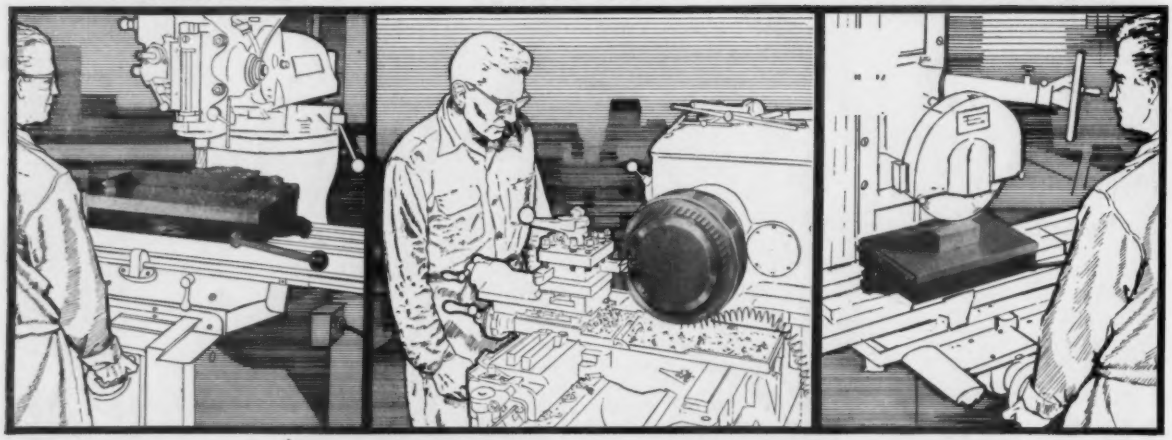
Nicholson File Company, Providence 1, Rhode Island • Files • Rotary Burs • Hacksaw and Band Saw Blades • Hole Saws • Ground Flat Stock • Industrial Hammers

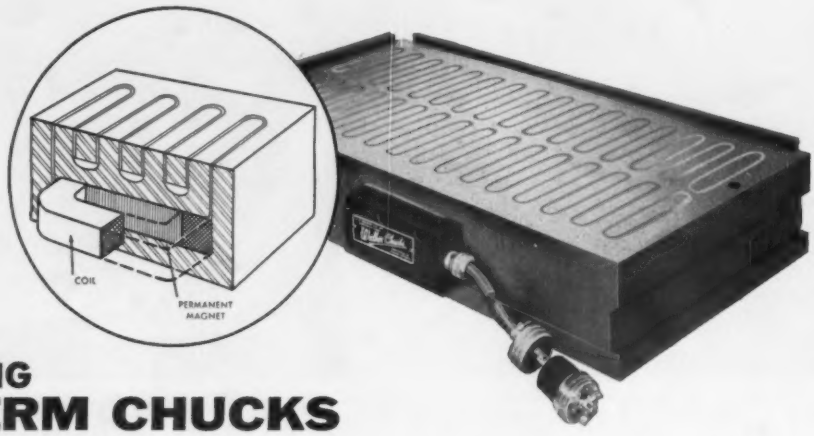
MILLING **TURNING** **GRINDING**



WALKER CERAMAX CHUCKS

Versatile Walker Ceramax Chucks featuring ultra-permanent ceramic magnets are successfully applied on grinders, millers, lathes, shapers and many other type machines. Powerful, rugged and stable, these permanent magnetic chucks can handle large heavy pieces or small thin stock with equal ease. The all steel top plate minimizes redressing and provides a long wearing precision work surface. Focused flux keeps the magnetism down near the top plate and away from the spindle and other machine parts. Alternating north and south poles of *equal* strength keep cutting tools demagnetized.

NEW



"COLD" OPERATING ELECTROPERM CHUCKS

Combining the advantages of both electric and permanent magnetic chucks, this new cold operating chuck represents the ultimate in precision for large magnetic chucks. The chuck is only energized and deenergized electrically while permanent magnets do the actual holding during machinery operation. Energizing and deenergizing cycles are so short that heat and accompanying distortion are eliminated. The cold operating Electroperm Chuck is so stable dimensionally that it will hold the precision tolerances of the machine tool upon which it is mounted.

Write for Catalogue WPL60 showing the complete Walker line of demagnetizers, magnetic and vacuum chucks.

O. S. Walker

O. S. WALKER CO. INC., WORCESTER, MASS.

Original Designers & Builders of Magnetic Chucks

General Dynamics to Develop High-Energy Impact Machine

A $220,760 contract for development of a high-energy impact machine for sheet metal forming has been awarded to the Advanced Products Department of General Dynamics by the Aeronautical Systems Division, Wright-Patterson Air Force Base, Dayton, Ohio. Contract also calls for a materials testing program to be done by GD/Fort Worth.

The department hopes to develop an impact rubber-type forming machine which will perform sheet metal operations beyond capabilities of machines now in use. Equipment available currently is not able to form the high-strength material required by the aerospace industry. Investigations will be made of several energy sources to power the prototype machine, which will be built at the San Diego facility. Test work will be done on the Dynapak (built by the department), a high-energy-rate extruding and forging machine using pneumatic power.

Raytheon Set to Buy Rheem Unit

Agreement in principle to buy all of the business and assets of the Rheem Semiconductor Corp has been reached by Raytheon Co, Lexington, Mass. The proposed acquisition, located in Mountain View, Calif, is a subsidiary of Rheem Manufacturing Co, New York. The business would continue to operate as it has in the past, with no substantial change in its 500-plus payroll, or product lines. Rheem's product line supplements, without duplicating, Raytheon's electronic component lines. Purchase would extend the scope of Raytheon's silicon devices so that both silicon and germanium product lines would meet requirements of the company's semi-conductor customers.

Airframe spars are forged in one piece with the aid of automatic duplicating die sinking on this giant Keller, one of several installed in the big Wyman-Gordon USAF plant at North Grafton, Mass. When this steel die for an aluminum aircraft spar 11 ft 10 in. long is completed, the die is used on the world's largest closed-die forging press of 50,000-ton capacity

Snow Acquired by American Gage

American Gage & Machine Co, Chicago, has purchased two companies through its affiliates—the Bellwood Manufacturing Co, and Laminated Metals.

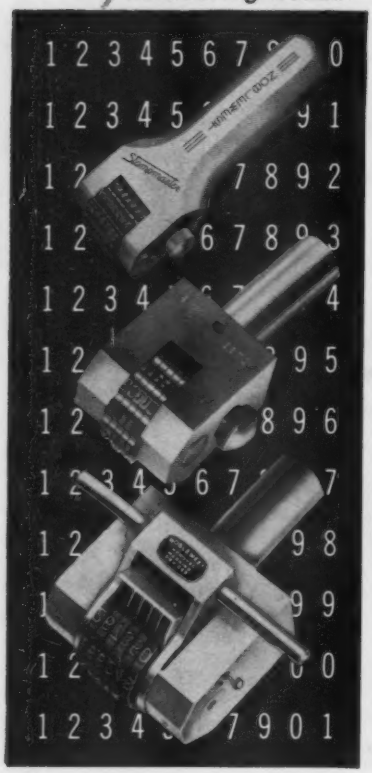
The Bellwood acquisition includes the Snow Manufacturing Co, Bellwood, Ill, builder of high-speed automatic tapping and drilling ma-

McGIRK'S WORKS

PUDGELY THERE IS MIGHTY ACTIVE ON THE JOB. I WONDER WHY HE STAYS SO OVERWEIGHT?
MAYBE IT'S A GLANDULAR CONDITION.
ON THE OTHER HAND, IT COULD BE HIS DIET.
MOE'S CORNER
My Doc put me on a high-protein diet.

for permanent metal numbering

noblewest offers 3 standard stock lines of numbering heads



Noblewest numbering heads are standard in the marking industry. For use in roll marking machines and presses, both plain and automatic styles are available in a wide variety of character sizes and number of wheels. Shown at top is Stampmaster hand numbering device. Center, Model 520 non-automatic economy model numbering head. Bottom, Model 10 automatic for serial numbering. Special models for any requirement. Write for literature.

NOBLE & WESTBROOK MFG. CO.
17 Westbrook St., East Hartford 8, Conn.

mark it best with
NOBLEWEST

FIELD REPORT

chines with automatic fixturing. Herman Goldberg, president and former owner will remain as president; Tom Owen, formerly head of the thread gage and tap division of Size Control Co, gage affiliate, will operate Snow as executive vice president.

The Laminated Metals purchase includes the Improved Seamless Wire Co, Providence, RI. The 68-year-old company specializes in bonding precious metals to base metals for use in electronic relay contacts, catalysts, optical frames, and missile work.

Hooker and Parker Huddle

Officers of Hooker Chemical Corp of New York and Parker Rust Proof Co of Detroit are negotiating for a merger of Parker into Hooker through stock exchange. If directors of both companies approve terms, the proposal will be submitted to stockholders at meetings to be held early next year.

Space Materials Department Established by Westinghouse

Westinghouse Electric Corp has formed a new department to coordinate all company activities in the development and application of structural materials that will withstand the extreme environmental conditions of space, re-entry, and hypersonic flight.

Located in the company's research labs at Pittsburgh, it'll focus its attention on special materials, both metallic and non-metallic, which are needed for such structural compo-

AM/MM

"You're a lathe man in the machine shop! Well, and all these years I thought you were hired to guard the water cooler."

TAKE IT FROM THE DRILL SARGE

NEW YORK TWIST DRILL
manufactures
TAPER SHANK DRILLS

extra tough and true too!

All regular series to 3½" O.D. available for immediate delivery —Specials made up to 1⅛" O.D.

New York Taper Shank Drills save you 25% on your twist drill bill — as do all the drills in our extensive line. If you wish further information, one of our sales engineers will be glad to call on you.

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Manufacturers of a complete range of standard and special drills in all popular sizes, lengths and types

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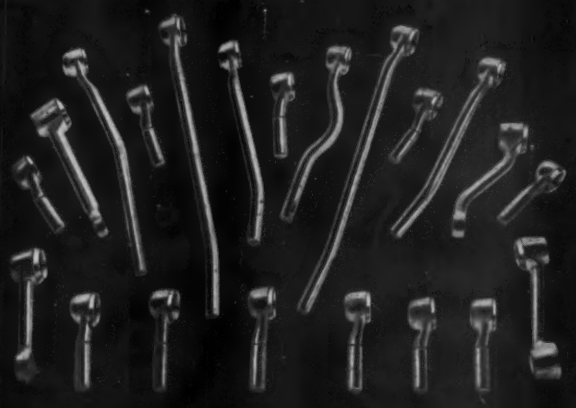
FLEXIBILITY
to process 25 different parts

Flexibility is featured in this Cross machine. One machine processes a variety of 25 different parts. The key to this flexibility is the fixture which holds any one of these varied parts with simple adapter changes.

The machine produces 675 pieces per hour and automatically unloads them onto a conveyor.

An improved chip and coolant system includes a conveyor that reaches right into the machine to remove the stringy chips.

The flexibility and efficiency you require is available in special machines by Cross.



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THE CROSS CO.

First in Automation

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With Reed Thread Rolls!

Take full advantage of the possibilities illustrated above which thread and form rolling offer to reduce costs and improve quality. Thread rolling also can eliminate many secondary operations.

Reed, pioneer-leader in the development of all types of thread rolling equipment, supplies thread and form rolls for a wide variety of applications.

Reed Thread Rolls manufactured under rigid standards of quality control are uniform . . . durable . . . accurate, and available for all types and makes of holders. Over 150 standard sizes regularly stocked . . . plus non-standard rolls on special order.

REED

ROLLED THREAD DIE CO.

Subsidiary of Union Twist Drill Company,
HOLDEN, MASSACHUSETTS
Specialists in Thread and Form Rolling Tools and Equipment

nents as rocket nozzles, vector control mechanisms, and nose cones. David C Goldberg, formerly advisory engineer at the Westinghouse astronuclear lab, will head the new department as director.

Cavitron-Cavitron Merger

Cavitron Ultrasonics Inc is the name of a new company resulting from the merger of Cavitron Corp, Long Island City, and its wholly owned subsidiary, Cavitron Equipment Corp. The company is a pioneer in the research, development, and manufacture of ultrasonic equipment for industrial and dental applications. Among its recent developments in the industrial field is the Ever-Grind, an ultrasonic aid to grinding operations which enables the wheel to grind cooler and cleaner.

Lycoming Contract

Contracts extending production of both titanium and conventional steel rocket chambers for the Air Force Minuteman ICBM have been received by Avco Corp's Lycoming Division, Stratford, Conn. Order comes from Aerojet-General Corp, Sacramento, Calif, prime contractor for the second-stage engine. Total value of the contract is in excess of $3.8 million of which $1.5 million is for the new titanium units.

Lycoming has been producing Minuteman second-stage rocket chambers since early 1959. More recently it produced and tested the first second-stage titanium chamber, reported to be the largest rocket chamber ever fabricated of titanium and successfully tested. Production of both the steel and titanium chambers requires extensive use of Lycoming's hydrospinning, three dimensional machining and closed circuit television welding capabilities.

West Coast Firm Formed to Make Materials Handling Equipment

Hamerslag Equipment Co, South San Francisco, has established Heco-Pacific Manufacturing Inc, a subsidiary organized to engineer and manufacture materials handling equipment. The firm will design and produce automation systems, overhead crane and conveyor installations, and electronic components for customized materials handling installations. It'll operate from the recently expanded Hamerslag facilities for the present.

Reed Roller Bit Enters Power Tool Market

Richmont Inc, and Livermont Inc, both of Monrovia, Calif, have been purchased for cash by Reed, Houston, Texas. This marks the fourth major acquisition by the company within the past two years.

Purchase includes patent rights held by Livermont on power tool torque analyzers and hand torque tools. Manufacturing, engineering, sales, and distribution facilities have been purchased from Richmont. The two concerns will become a part of Reed's Cleco Division.

Harron, Rickard & McCone Buys Marwedel

Garret Corp has sold its subsidiary, Marwedel, in San Francisco, to Harron, Rickard & McCone Co of Southern California. Marwedel, nationally known industrial supply house, and the Bay area's oldest and largest supplier of tools, metals, and industrial products, has served western industry for nearly a century.

William F Wolf, president of Harron, reports that his company, which last year also acquired Acme Machine Tool Co in San Diego, will continue to emphasize the sale of machine tools in the southern California areas but that Marwedel, with its many nationally known brand lines, will offer excellent diversification.

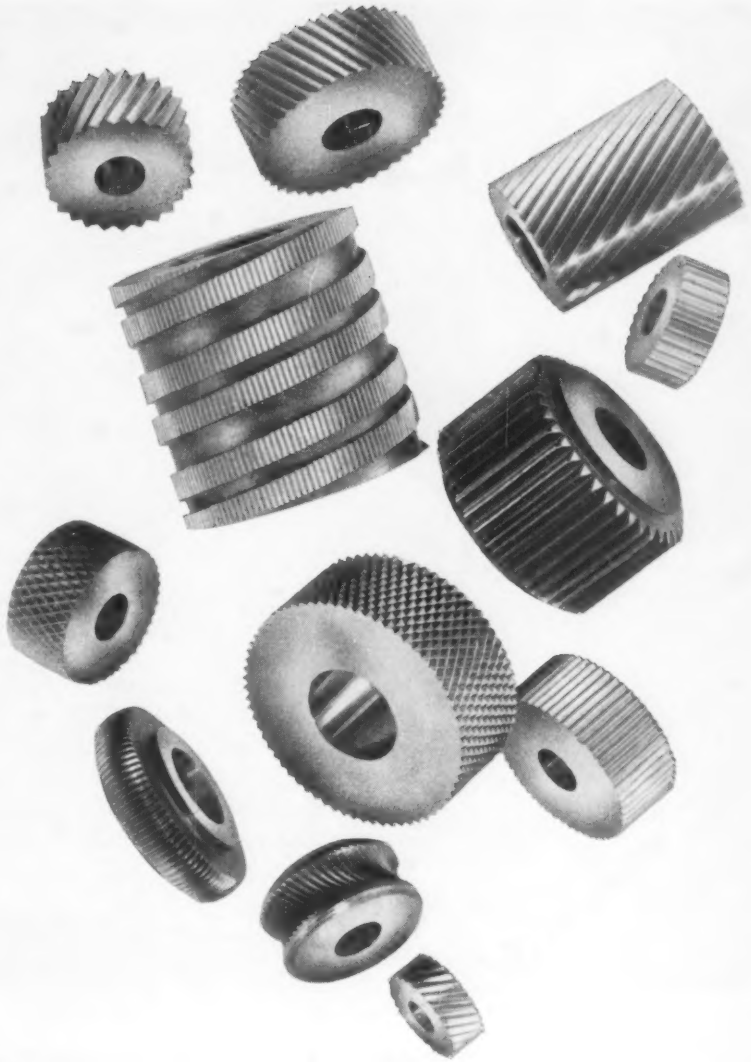
Norair to Work on $24 Million Job

Norair Division of Northrop Corp, Hawthorne, Calif, has received a contract for production of 144 T-38A aircraft.

(continued on p231)

AM/MM

"Stop fretting! You'll feel better after you've hollered at a few of the boys at the shop!"



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Yours With Reed Knurls

Reed Knurls produce accurate, smoothly finished surfaces. Careful selection of steel, controlled heat treatment and an exclusive lapped finish insure maximum life. Precise manufacturing control provides uniformity of tooth form, diameter, thickness, hole size and concentricity.

Reed stocks over 170 styles and sizes of *circular* pitch and *diametral* pitch knurls. As the pioneer-leader in the development of all types of thread and form rolling equipment, let us solve your knurling problems. Reed Knurls are stocked by your Industrial Supply Distributor.

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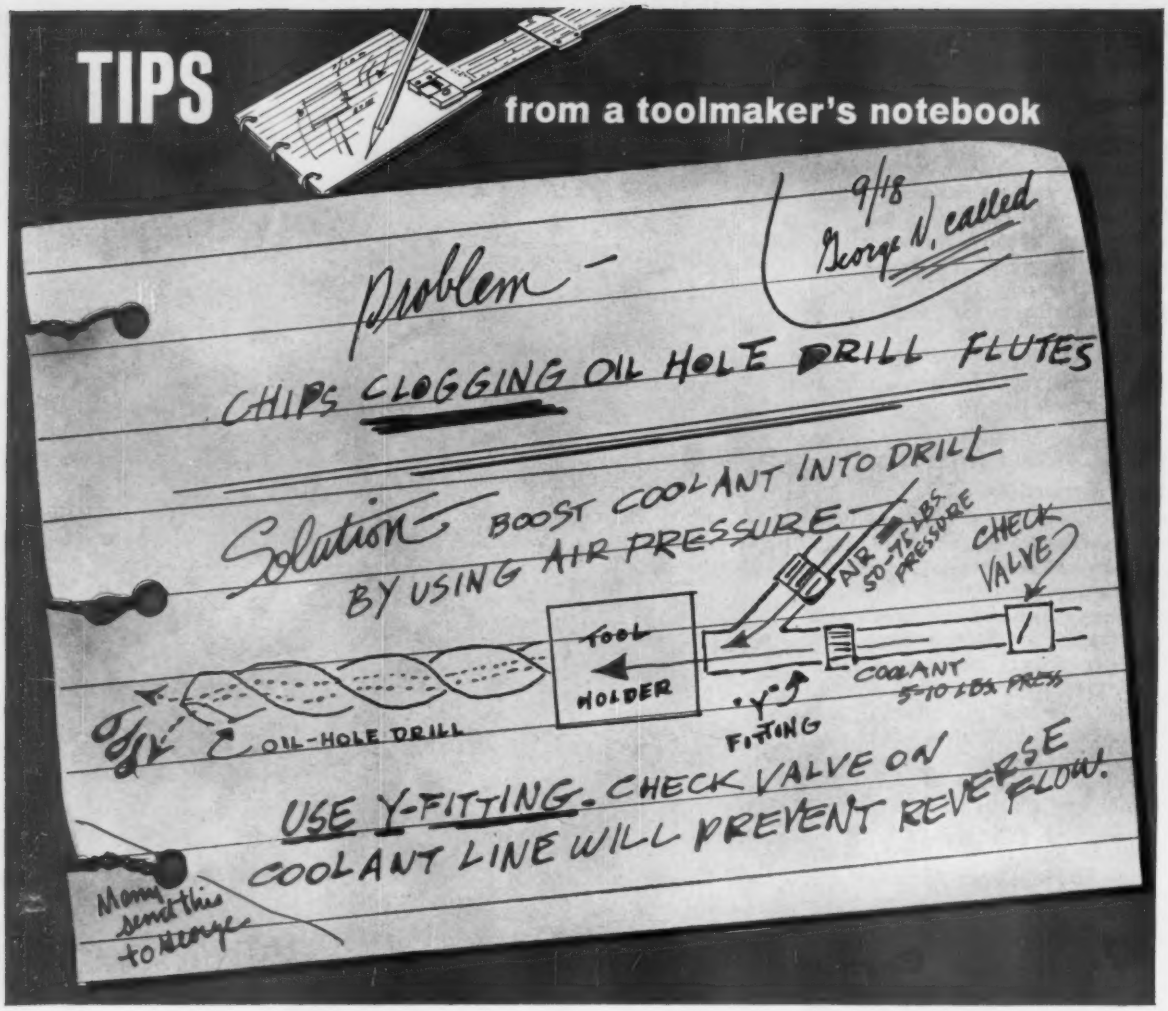
Subsidiary of Union Twist Drill Company,
HOLDEN, MASSACHUSETTS
Specialists in Thread and Form Rolling Tools and Equipment



It's the business of engineers at Chicago-Latrobe to solve metal-cutting problems. Whether it's a case like the one above or a sophisticated setup involving tape control, C-L is certain to have experience that can save you time and money.

Begin the contact by calling in your local C-L Distributor or C-L Sales Engineer ...or by writing Chicago-Latrobe direct...do it today.

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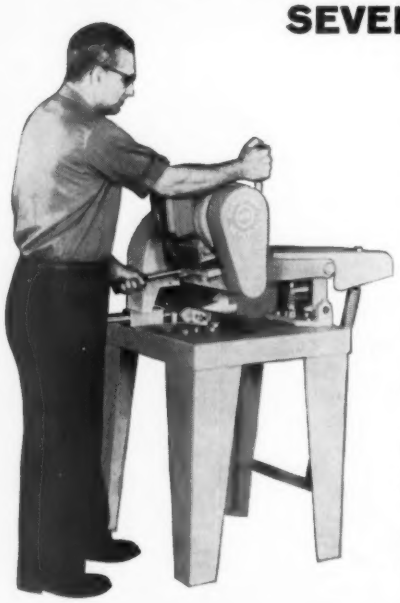
12 seconds per cut on this 2-inch steel bar!

SEVER-ALL MODEL 1-A gives high-quality cuts at low cost



Even the newest super alloys can be cut at 3 to 6 seconds per square inch on the Sever-All Model 1-A dry abrasive cutting machine. The burn-free slices of hardened steel shown above are typical of the cuts you'll get on almost any metal. *You get this speed and quality for an investment of approximately $500!*

You get big capacity, too, with the Model 1-A—up to 2″ square solids, 3½″ O.D. pipe and tubing, 3″ angle iron and 4″ channels. You can cut practically any metal. On top of that, wheel oscillation—an "exclusive" in this price range—provides cooler cutting, longer wheel life.

The Model 1-A is so easy to use, too. Wheel selection is simple—just two types of wheels do *all* your Sever-All cutting jobs. Minimum set-up time required.

You can get immediate delivery from your Sever-All distributor. ***Write*** us for his name — or ask for **Bulletin DH-106** for details on the Sever-All Model 1-A.

SEVER-ALL ABRASIVE CUTTING MACHINES

ACCO

Allison-Campbell Division • American Chain & Cable Company, Inc.
923 Connecticut Avenue, Bridgeport 2, Conn.

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LEAD

Youngstown leaded steels increase your production, prolong tool life

Adding lead to steel is a Youngstown art, hard to learn. You add the right amount at the right time. Disperse it. Keep the content range correct. Check it, test it, inspect it, control it from the teeming floor to finished hot rolled and cold drawn bars.

Youngstown Yolead and other leaded steels give you better machinability, longer tool life and faster cutting speed. You get more reliable performance, improved ductility. You get lower costs. From small carburetor fittings to big automotive forgings, Youngstown can provide the exact leaded grade that you need, when and where you need it.

Get all these advantages with leaded carbon and alloy steels from Youngstown. Get fast, dependable delivery from your Steel Service Center, and through 28 Youngstown offices. Get quality, get performance, get leaded steel from Youngstown who knows how to make lead behave inside steel.

Youngstown – growing force in steel

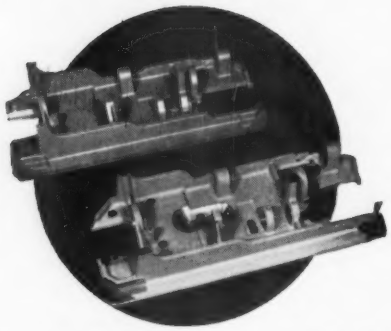
For more information about Youngstown leaded steel, write: Dept. 15-B
The Youngstown Sheet and Tube Company, Youngstown, Ohio

Sub-contracting precision parts, assemblies and machines like these... is our business!

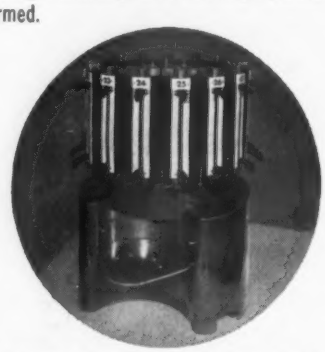
(but we want more of it)

We'd also like to prove to you what our completely integrated manufacturing facilities* can mean to you in terms of lower costs, faster delivery, and complete satisfaction.

TMW's facilities and 65 years' experience in high-precision (tolerances to tenths) manufacturing are available to you *now*, on a short or long-term basis. For details or a new Facilities File Folder, call or write today.



A TMW gray iron casting before and after precise machining, annealing and finishing operations were performed.



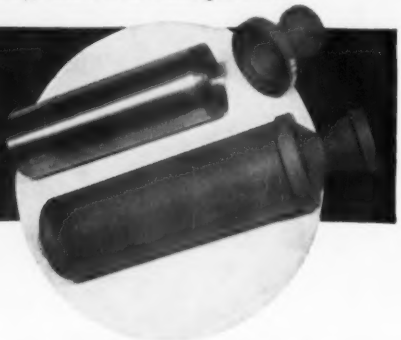
Paint dispenser was economically mass produced for a major manufacturer in TMW's modern shops.

"The world's first and only automatic stud fastener" . . . (another example of TMW precision machining and assembly) carries a LIFETIME guarantee.

* Includes 1,000,000 sq. ft. of manufacturing space, 1200 *modern* machine tools, completely mechanized foundry (one of the world's largest), 3000 skilled craftsmen with a corps of top designers and engineers.

TEXTILE MACHINE WORKS

Contract Division • Reading, Pennsylvania



Jato units, used on the "Honest John" rocket to make it spin, are machined to ±.0002" tolerances and hydrostatically tested to meet strict government specifications.

◄ CIRCLE 431 READER SERVICE CARD

▲ CIRCLE 432 READER SERVICE CARD

FIELD REPORT

New Ordnance Works Established By Thompson Ramo Wooldridge

TRW, one of the producers of Army's M-14 rifle, has set up a separate Ordnance Works at its Tapco plant in Euclid, Ohio. Company, which has received a $8.5 million production contract for 100,000 rifles (with first deliveries to begin in 13 months) also has a second contract for $6.5 million which will be used to buy production equipment and machine tools.

The Ordnance Works will manufacture 11 of the 16 major parts of the M-14, and utilize several hundred subcontractors, many of them small businesses, for additional tooling, design, special machining, materials, and other support activities. Entire assembly and test will be done within the company.

$11 Million Order to Cadillac

Army has awarded a $11.7 million contract to the Cleveland plant of Cadillac Motor Car Division of General Motors for production of two new types of self-propelled artillery.

Harvey Aluminum Sales Corp . . .

. . . contractor for the Milan Arsenal at Milan, Tenn, has been awarded a new $6 million government contract to meet higher production needs. As a result, the Arsenal will add 200 employees to its payroll, bringing employment to 1000. The facility produces classified items of ammunition in the medium caliber range.

(continued on p234)

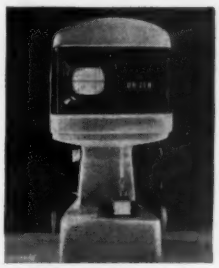
AM/MM

"I limit myself to one coffee break a day—at the moment I'm six months ahead."

PRECISION PRODUCTION PROBLEMS?

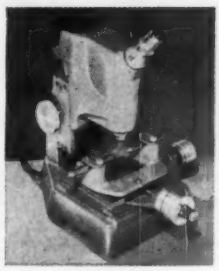
Here's help from Bausch & Lomb in

TOOL DESIGN
INSPECTION
FABRICATION
MEASURING
TESTING



DR-25B OPTICAL GAGE
Fastest, easiest way to measure depth, thickness, height, diameter, taper. Read direct to 0.0001" on bright, magnified scale.

10" BENCH PROJECTOR
Exclusive understage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes show errors instantly. Reads to 0.0001" with optional micrometer stage.



TOOLMAKERS' MEASURING MICROSCOPE
Quickly measures transparent or opaque objects of any contour. Linear, accurate to 0.0001"; angular, to 1 minute of arc.

SCRATCH DEPTH GAGE
With this simple hand-held instrument you can measure the depth of any scratch to 0.0001", with a range of 0" to 0.015".

STEREOZOOM® MICROSCOPES
Big, bright 3-D views of tiny parts. Zoom to any magnifications you need for assembly, inspection. Dustproof, shockproof—can be mounted right in machines.

DIE-WEAR MICROSCOPE
See readily if die **needs** sharpening, and **exactly** how much metal must be removed. Direct, easy-to-read measurement of die wear up to 0.020" . . . accurate to 0.0001".

ZOOM MACROSCOPE
Measure direct to 0.0001" — at any magnification from 10x to 30x — with constant focus throughout.

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☐ DR-25B Optical Gage ☐ Toolmakers' Measuring Microscope ☐ StereoZoom Microscopes
☐ Zoom Macroscope ☐ 10" Bench Projector
☐ Scratch-Depth Gage ☐ Die-Wear Microscope

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....
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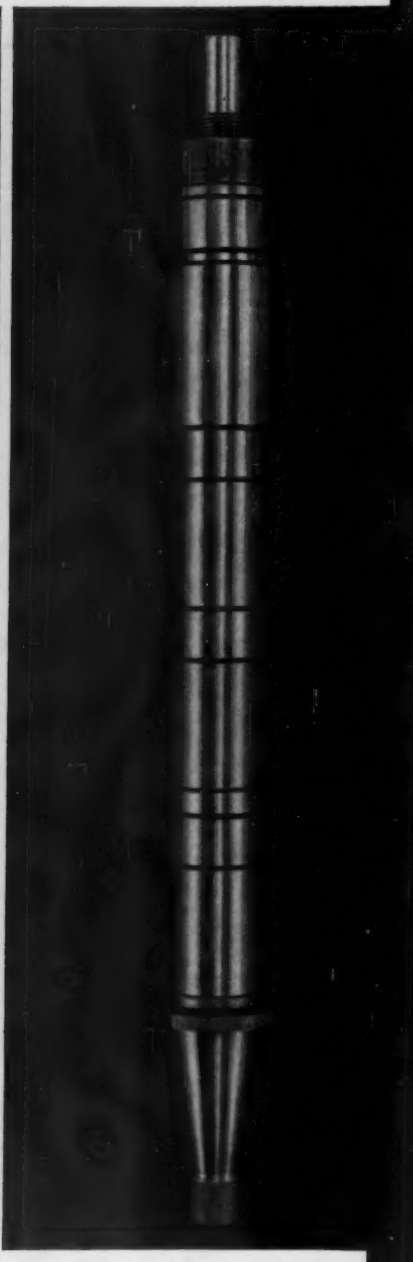
A "live" demonstration from Brown & Sharpe...

"Let me show how you can save milling machine - by using

...Mr. Kenneth E. Wood, Assistant to Manufacturing



"Your cutters last up to 3 times longer, held on B&S arbors. And the runout is as little as ⅛ the runout you get with other arbors—your accuracy up to 8 times better!

"Sounds hard to believe, but these are honest figures, taken from tests and records comparing Brown & Sharpe and competitive arbors.

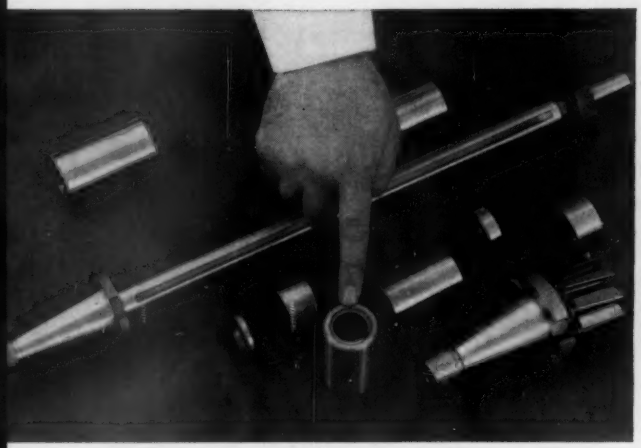
"Milling machines are only as good as the arbors you put in them. Cutting tools are only as good as the arbors you use to turn them. You can preserve machine accuracy, extend cutter life and minimize work rejects by switching to better arbors.

"Look at what you get in Brown & Sharpe arbors. I think you'll agree!

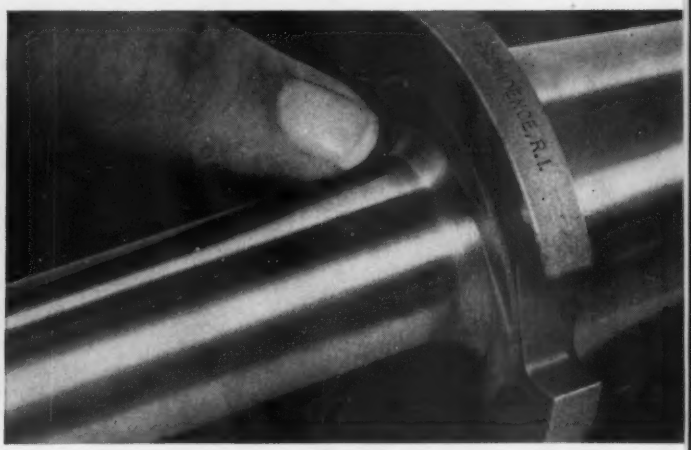
CIRCLE 434 READER SERVICE CARD

money in almost any make of Brown & Sharpe arbors"

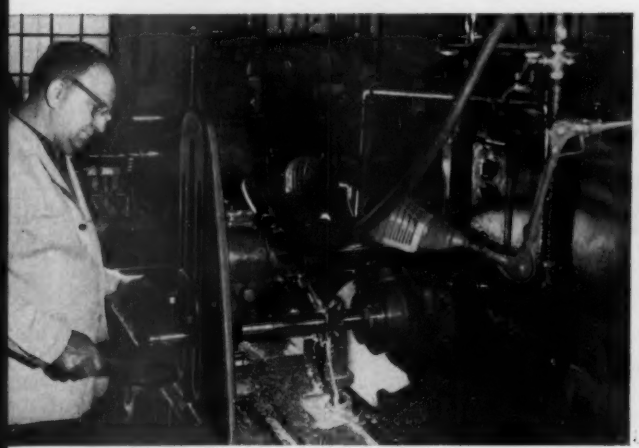
Manager, Industrial Products Division.



"See these faces? They're lapped parallel within .0001" (on Brown & Sharpe's 'Jo-Block' equipment!) Cutters centered by the collars and sleeves won't wobble . . . squareness of the shoulder flange is transmitted right down the line. All parts are through hardened to approximately 200,000 psi — not just case hardened. All diameters and tapers are precision ground.



"You'll note there's a radius fillet where the shaft joins the shoulder, instead of a sharp corner. It reduces fatigue and flexing, by beefing up the arbor at its most critical point. The extra-fine finish on Brown & Sharpe arbors adds strength, too. Most arbor makers don't bother with these details, but when the chips start to fly, details can make a big difference to you!"



"No matter what makes of milling machine you use — on your production line or in your toolroom — you can usually get B&S arbors to fit them. Brown & Sharpe makes over ninety arbors, with Number 30, 40 and 50 Standard tapers as well as B&S taper shanks. This is the widest line offered by any machine tool builder — a better line backed by Brown & Sharpe's know-how in cutters *and* milling machines.

"For all this quality, you pay no more. That's the surprising part. Brown & Sharpe arbors are priced about the same as other widely used arbors — lower than those offered by other manufacturers of milling machines. You can buy B&S arbors 'bare' — or with collars and sleeves."

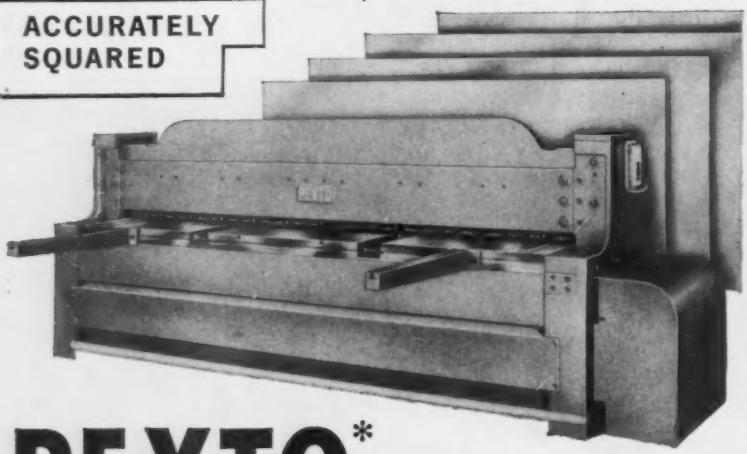
Ask your Brown & Sharpe distributor for "the arbors that save money!" Brown & Sharpe Mfg. Co., Providence 1, R.I.

Brown & Sharpe PRECISION CENTER

CIRCLE 425 READER SERVICE CARD

Continuous Full Rated Capacity means BIGGER dollar for dollar VALUE!

ACCURATELY SQUARED



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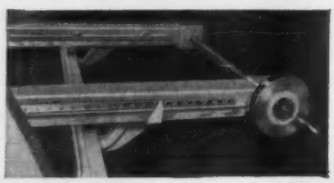
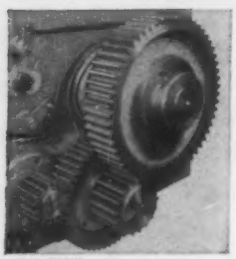
10-U-10
A complete line

*Registered Trademark

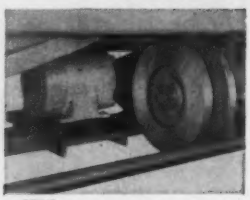
PEXTO Power Squaring Shears have design features that provide unparalleled full capacity shearing with squaring accuracy, delivering top production all day, every day... even at full-rated capacity.
These world famous Squaring Shears are built from heavy, high-grade machine tool castings, and have self-compensating holddowns, precision gauging with maximum cutting-life from four edged blades.
These are but a few of the important features PEXTO Power Squaring Shears offer. Write for the latest literature.

STANDARD BACK GAUGE
NEW improved design. PEXTO has added a new measure of precision, with fast, self-reading dial setting. Gauge can be locked in any position. Graduated in 128ths of an inch.

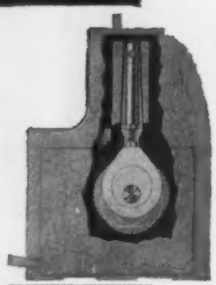




GEAR TRAIN
Double reduction gearing through modern 20° pressure angle steel pinions and cast gears provides smooth power transmission.



DRIVE
Higher flywheel speed and Timken bearings add accuracy and smoothness. Motor base can be adjusted in seconds.



CROSSHEAD SUSPENSION
A unique method of mounting means efficient use of power and effective reduction of side-thrust and wear.

Pexto Squaring Shears are sold through Dealers and Distributors... Send for Bulletins 57 and 60.

THE PECK, STOW & WILCOX CO. Southington, Conn., U.S.A.
A complete line of machines and tools for Sheet Metal Fabrication ... Since 1783

FIELD REPORT

Thiokol Chemical Contract

Letter contract for $4 million has gone to Thiokol Chemical Corp for production of packaged liquid propellant rocket engines for Bullpup missiles. Immediate result of the order, which will be carried out at the company's reaction motors production plant in Bristol, Pa, will be employment by the end of the year of several hundred additional skilled shop workers, including turret lathe operators, assemblers, and inspectors.

Mirrobore Division . . .

. . . of DeVlieg Machine Co, Royal Oak, Mich, is now manufacturing and distributing Conner type spade drills. Tools of this type were formerly produced by Gairing Tool Co, which recently ceased operations. The new Microbore line includes X and Y type spade and core drills as well as holders. Drills are being produced with HSS or cemented carbide tips.

Machine Tool Leasing Plans

CIT Leasing Corp, machinery and equipment leasing affiliate of CIT Corp, has expanded its operations nationally in the machine tool field. Company, which has 22 division offices in all parts of the US from Seattle, Wash, to Jacksonville, Fla, will offer leasing plans designed to meet the special requirements of the machine tool industry with terms from five to 10 years.

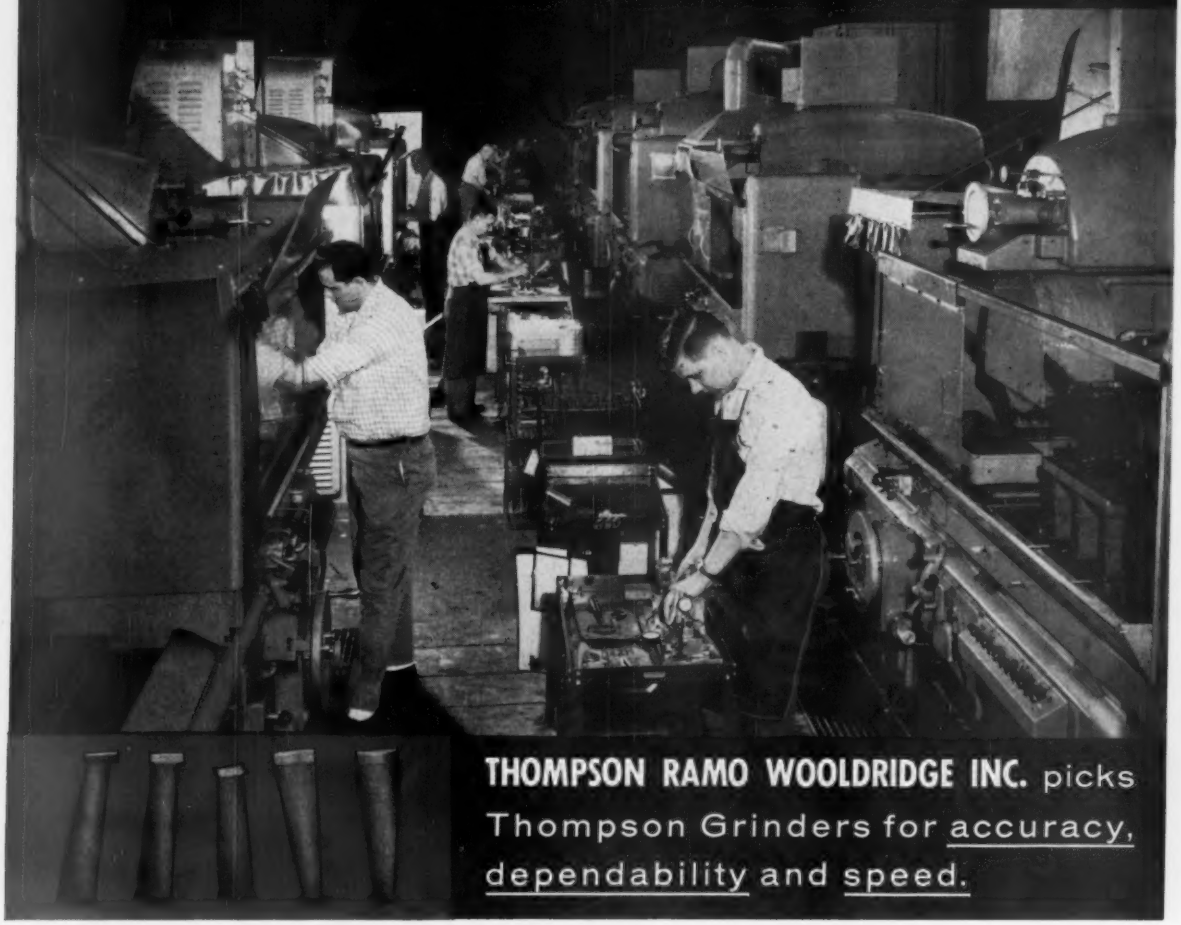
AM/MM

"I never thought my job would include having to dictate hair styles!"

This well-known manufacturer depends on . . .

A BANK OF THOMPSON GRINDERS

. . . for a tough production job.



THOMPSON RAMO WOOLDRIDGE INC. picks Thompson Grinders for accuracy, dependability and speed.

All the Thompson machines shown above in one bank are grinding jet aircraft engine compressor vanes. Each of the 5 surfaces on the root end as well as the concave and convex airfoil surfaces on the lug end are ground to extreme accuracy on the stainless steel forgings.

For the five years that these Thompson machines have been steadily on this job, downtime and maintenance costs have been negligible factors.

Put your toughest production job on a Thompson grinder and watch it cut your costs, speed your production and improve your product.

THE THOMPSON GRINDER CO. Springfield, Ohio

"Keep *in mind for that daily grind"*

THOMPSON SURFACE GRINDERS

AUTOMATIC BRUSHING SETUP buffs mirror finish on 12" wrench parts for plating. Multiple parts are mounted in special removable fixture. Machine automatically positions and oscillates parts between brushing heads for 25 strokes per cycle. Each head is made up of 65 Osborn Bufcut® treated cord brushes.

MIRROR FINISHING wrenches

nine at a time with OSBORN power brushing

This leading tool manufacturer uses Osborn power brushing to buff a mirror finish on forged steel wrenches, pliers and chisels before plating.

Pre-mounted in multiples on removable fixtures, the tool parts are buffed in a special machine which automatically lowers and oscillates the parts between two Osborn Bufcut® brushing heads. The operation is simple, fast, inexpensive. This method has been in continuous use in this plant for nearly 12 years—*still proves to be the best way to do the job today.*

It's a typical example of how Osborn power brushes and brushing methods—through years of exceptional, dependable service—are handling industry's tough metal finishing jobs. If you have a metal finishing problem—deburring, cleaning, polishing, precision blending—an **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, can pinpoint the answer. *Write or call The Osborn Manufacturing Company, Dept. C-118, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

OSBORN

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

FIELD REPORT

Adamas Licensed by Ford

Adamas Carbide Corp, Kenilworth, NJ, has been licensed by Ford Motor Co to manufacture Ford-patented titanium carbide materials. These materials, containing titanium carbide, molybdenum, and nickel have proven to be highly effective in certain cutting tool applications.

Howe Sound Co . . .

. . . New York metals manufacturer, has acquired Pennsylvania Electric Steel Casting Co of Hamburg, Pa. Purchase includes all plant facilities and inventory of the steel casting products firm which will be operated as a division of Howe, with the same name and management.

Mosman Industries Inc . . .

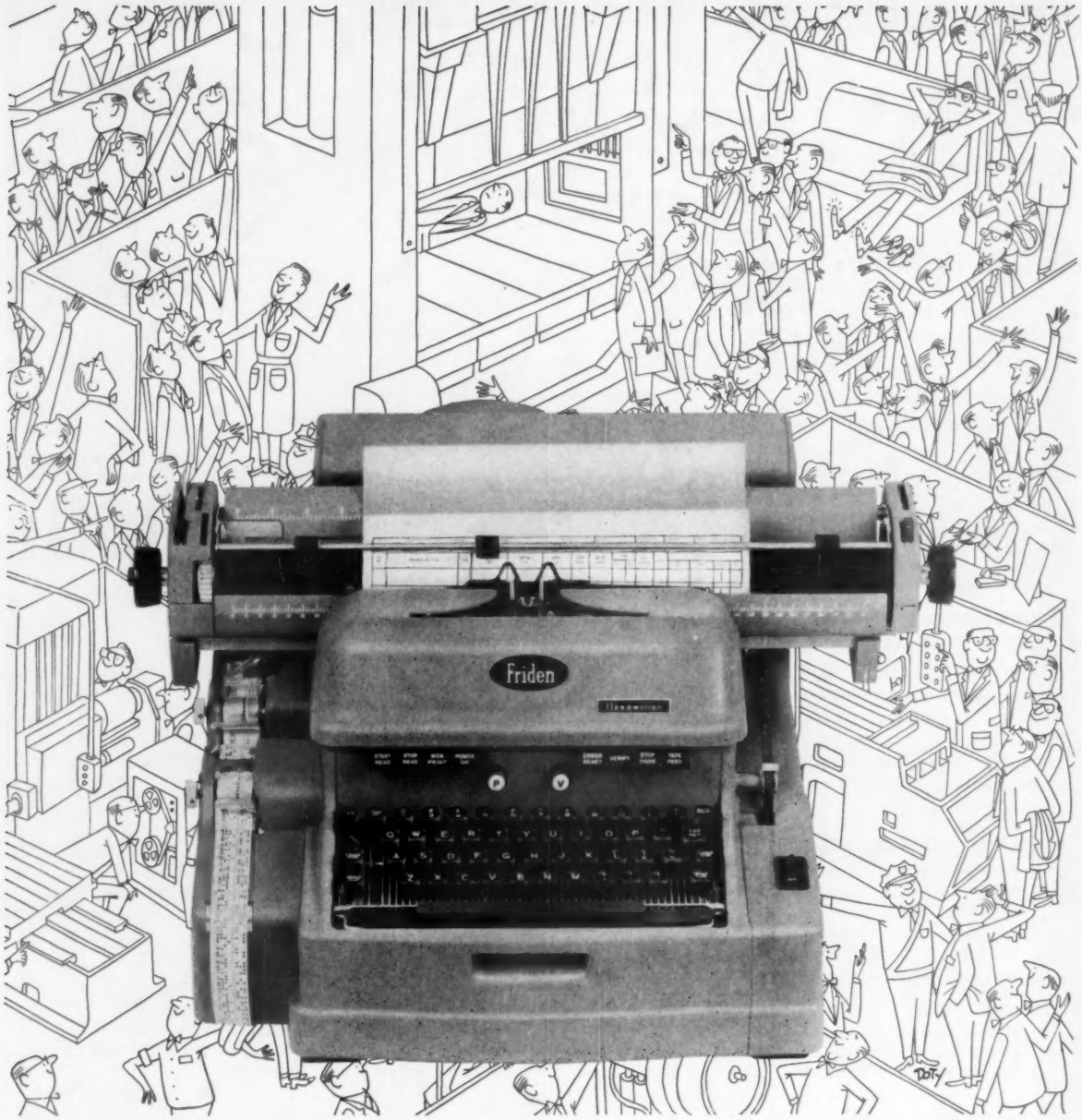
. . . Hamilton, Ohio, has acquired controlling interest in Harriman Manufacturing Co, Chattanooga, Tenn, farm machinery and implement manufacturer. Mosman will spend $150,000 on new buildings and machinery at the facility.

Aerojet-General Buys Big

State of Florida has leased a 25,313-acre tract below Miami to Aerojet-General Corp for construction of a multi-million-dollar manufacturing plant. Type of installation so far has not been disclosed; under terms of the agreement the firm has pledged to build a manufacturing facility within 12 months or forfeit the lease.

AM/MM

"Ellen's laid up, and I'd be darned if I could operate her automatic washer."



The Friden Flexowriter® Machine Tool's Machine Tool

At the recent Machine Tool Exposition, approximately 80% of the numerically controlled tools on display featured 8-channel punched paper tape input.

The toolmakers have shown this overwhelming preference for punched paper tape for several reasons:

1) the tapes are easy to prepare,
2) the coding is visible,
3) tape can't get out of sequence,
4) tape is durable and unaffected by chance exposure to magnetic fields.

By standardizing on paper tape input for your numerically controlled tools, you get all the benefits listed above, plus one more: It's so much easier (and less expensive) when all of your numerically controlled tools can be programmed on one device. That device? The Friden NC-1 Flexowriter—the machine tool's machine tool.

THIS IS PRACTIMATION: Friden is the world leader in tape technology and the practical application of the automation it makes possible. For full information, call your local Friden Systems Representative. Or write: Friden, Inc., San Leandro, California.

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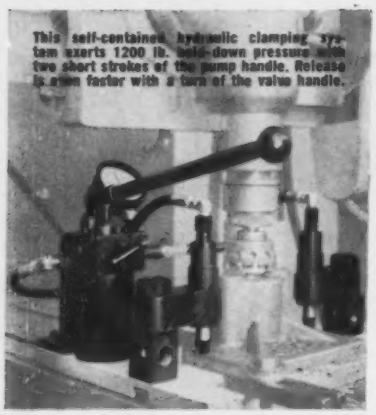
Friden

Sales, Service and Instruction Throughout the U.S. and World

Hydraulic Clamping SLASHES Production Costs


This self-contained hydraulic clamping system exerts 1200 lb. hold-down pressure with two short strokes of the pump handle. Release is even faster with a turn of the valve handle.

NEWTON HYDRAULIC CLAMPING SPEEDS UP YOUR PRODUCTION...

Newton Systems permit rapid operation of many clamps simultaneously . . . just a matter of seconds compared with minutes by mechanical clamping. Let Newton Hydraulic Clamping Systems add new profits to your operations.

NEWTON HYDRAULIC SYSTEMS PROVIDE:

- Controlled clamping pressure
- Safe, economical operation with minimum maintenance
- Greatly reduced clamping time
- Multiplicity of clamping positions
- Portable units with set-up versatility — independent of outside power source
- Wide range of pumps, cylinders and mounting devices
- Adaptability to automation

A Newton engineer will be happy to advise you on the type of equipment best suited to your needs. Fill in the coupon below.

I'd like more information on speeding up production with NEWTON HYDRAULIC CLAMPING SYSTEMS.

☐ Send literature
☐ Have representative call

Name & Title_____
Company_____
Address_____
City_____ State_____

NEWTON

HYDRAULIC TOOLING CO., INC.
AUBURN, MASSACHUSETTS

FIELD REPORT

$17 Million Add-On to Martin

Martin Co has received an additional contract to step up production of the Bullpup missile. Work for the first time will be placed on a two-shift basis at the firm's Orlando, Fla, plant where the bomber pilot-guided devices are being turned out.

Douglas Gets New Nike-Zeus Work

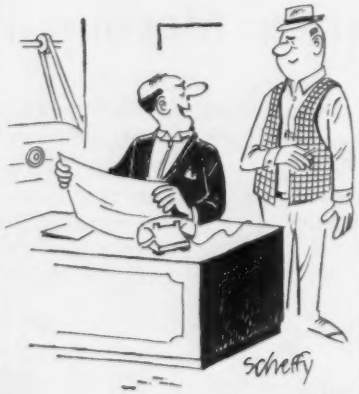
Douglas Aircraft Co of Santa Monica has been awarded a $57.7 million subcontract under an extended program for development of the Army's Nike-Zeus anti-missile missile system. This is part of an overall additional contract of $171.8 million for developing and testing the missile for another 12 months. Douglas builds the missile body; primary contractor is Western Electric Co.

More Shillelagh Work to Ford

Army has awarded an $8 million contract to Ford Motor Co's Aeronutronic Division for continued development of the Shillelagh missile system. Work is to be performed at the Newport Beach, Calif, facility.

O S Walker Acquires Shrader Co

F W Shrader, Los Angeles manufacturer of electro and permanent magnetic equipment, has been acquired by O S Walker Co, Worcester, Mass maker of permanent and electromagnetic chucks. Other Walker subsidiaries are Buck Manufacturing Co, and Bux Magnetic Products Inc, both in San Jose, Calif, and Hagou-Eindhoven, Holland. Eventual consolidation of Shrader and Bux is planned. •



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"A splendid production schedule, Grimes—they'll never come anywhere near it."

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That's what our non-profit development corporation paid for a survey to determine what kind of industry we are best equipped to serve.

The survey by the nation's outstanding consulting firm **discovered five competitive advantages vital to machinery manufacturers.**

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this new chart makes TAP selection foolproof and almost automatic

A revolutionary new color-code developed by Besly-Welles is at the bottom of it all. The only requirements for making 75% of all tap selections—and making them right—is the knowledge of four colors and the material to be tapped.

And it's just that easy. No hidden tricks. No guesswork. The Besly Color-Keyed Tap Selector leads you quickly and easily through three simple steps to tap selection. It takes you right down to the exact size, pitch and pitch diameter tolerance. It even gives you the catalog number to use.

And out of it all, of course, your selection is made from the well known Besly line of top quality taps for industry.

For very special or complex jobs ask your distributor to arrange for a Besly tap specialist to work with you.

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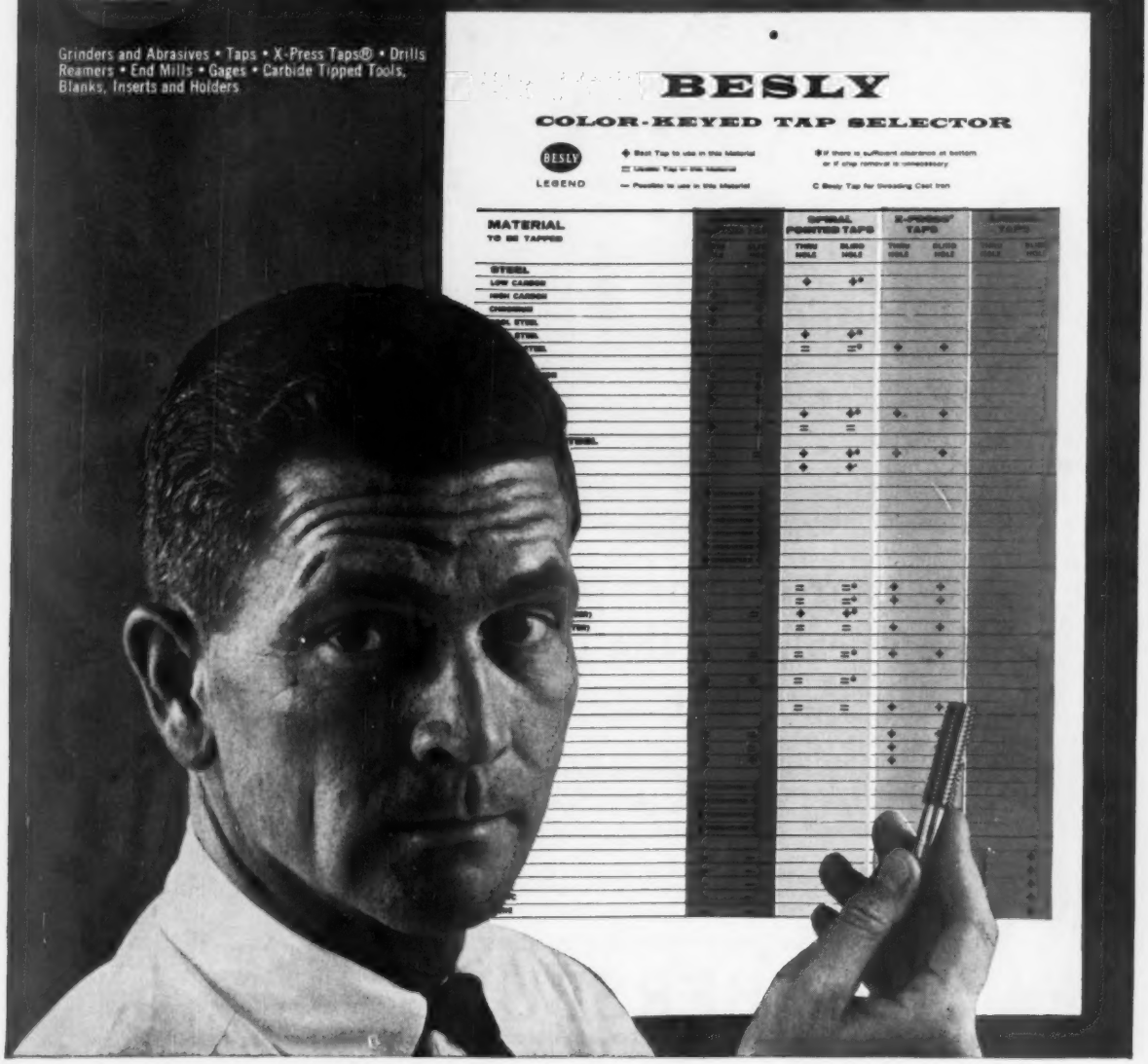
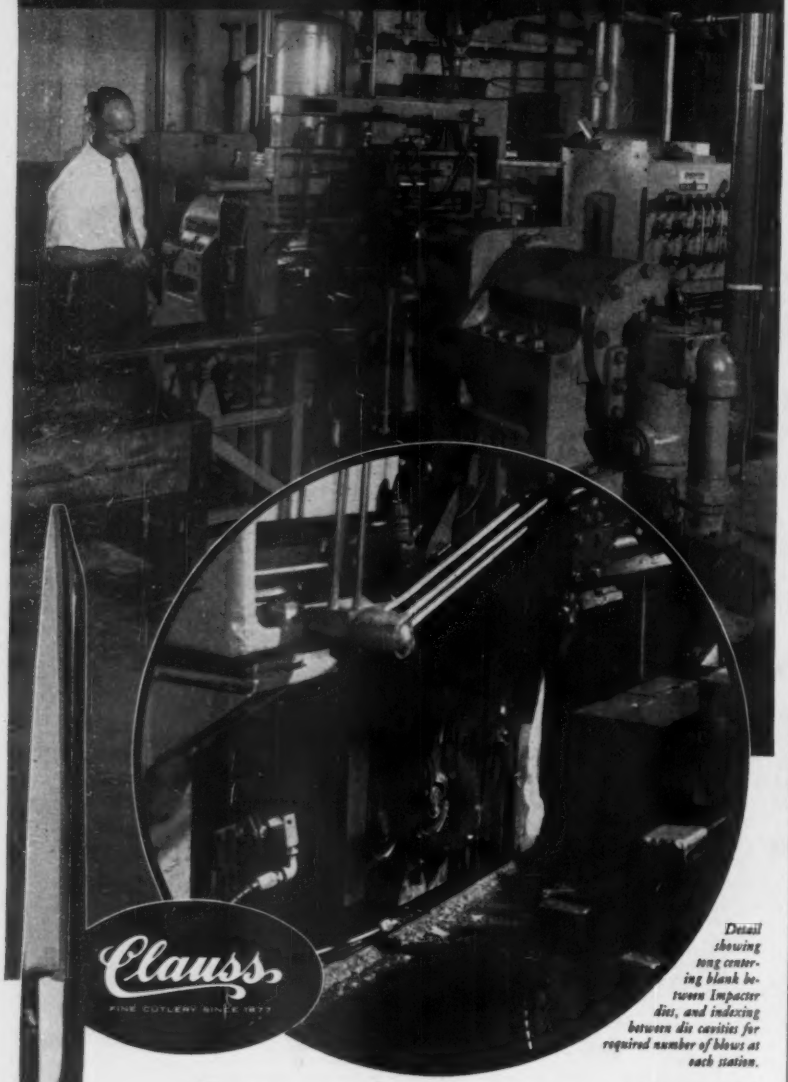


"The Model 'C' Impacter achieves new peaks of production speed and efficiency for Clauss"



Detail showing tong centering blank between Impacter dies, and indexing between die cavities for required number of blows at each station.

Scissor forgings produced automatically on the Impacter ..faster, better, more uniform

Clauss Cutlery Company, of Fremont, Ohio, famous manufacturer of scissors, shears and snips, is achieving remarkable results with the Cecomatic Forging Process, incorporating the Model "C" Impacter.

Better quality forgings are produced faster, with reduced scrap, and less stock required.

Dies last longer, scaling is reduced and parts dimensions vary less, greatly reducing mismatch of mating parts, according to R. W. Van Hook, Vice President, Clauss Cutlery Co.

Write for details and a copy of Bulletin 110-L-1, "Cecomatic Process for the Jobbing Type Production of Drop Forgings."

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PA.

CHAMBERSBURG

THE FRANKLIN INSTITUTE'S 1961 LONGSTRETH MEDAL "FOR INVENTIONS OF HIGH ORDER" WAS AWARDED THE DESIGNERS OF THE IMPACTER

Two Precision Machining Firms Acquired by Mertronics of LA

Mertronics Corp, Los Angeles manufacturer of missile components, and licensor of the Mercury casting process, has acquired assets and facilities of Acrosonics Inc, and the Hollywood Manufacturing & Supply Co, both located in Los Angeles. The two companies will be combined to form a new wholly owned subsidiary of Mertronics named Acrosonics Corp which will also operate a facility known as the Hollywood Manufacturing Division.

New company has complete facilities for precision machining and sheet metal fabrication, certified welding, and electronic assembly and wiring operations.

Consolidated Aluminum Corp . . .

. . . Jackson, Tenn, has purchased from TVA a 235-acre tract near New Johnsonville, Tenn. Although Consolidated has made no official announcement, the acquisition lends support to industry rumors that the firm will build a $28 million aluminum plant at the site.

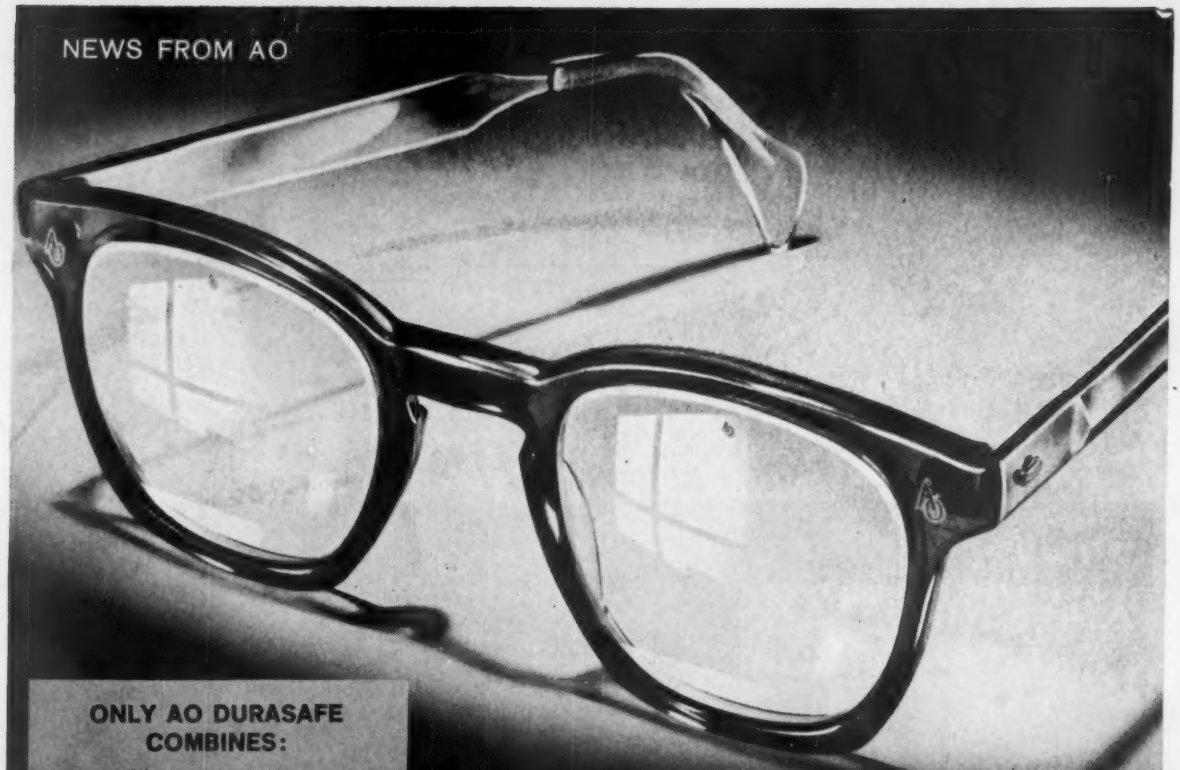
Continental-Emsco Order

Contract in excess of $1 million has been received by Continental-Emsco Co, Dallas-based division of Youngstown Sheet & Tube Co. Awarded by the Corps of Engineers Ballistic Missile Construction Office in Los Angeles, order provides for delivery of 57 sets of wheel truck assemblies for all Titan II ICBM sites. Each wheel weights about 15,400 lb.

AM/MM

"Shall we make it together?"

NEWS FROM AO



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ONLY AO DURASAFE COMBINES:

7-barrel hinge—40% stronger at temple's most vulnerable spot.
Duragrip screw construction—screws cannot fall out, temples stay tight.
Sturdy frames—extra strong, engineered for industrial use and exposure.
Wider temples, endpieces—strong, more comfortable, better appearance.
Cool side shields—nonreflecting wire mesh.
Easy to identify—AO monogram on frames and lenses identifies Durasafe at a glance.

TAKE YOUR CHOICE OF

Solid colors
Smoke (F9800SM)
Mahogany (F9800M)
Pink Crystal (F9800PC)
Two-tones
Smoke on Crystal (F9800SC)
Mahogany on Crystal (F9800MC)
Black on Crystal (F9800BC)
Temples
Plastic comfort cable
Metal core plastic spatula
Aluminum with plastic tip
Full range, bridge & eye sizes
Safety Rx or plano lenses
With or without side shields

...the glasses workers wear willingly

Your plant eye protection program's *full* effectiveness is governed by the workers' willingness to wear safety glasses (or goggles) regularly. In the new Durasafe, you have fitting qualities and a choice of colors and combinations that satisfy everyone . . . combined with the latest safety features that mean maximum protection and durability.

This wearer acceptance can be a big factor in preventing costly eye injuries. For the new Durasafe will protect against 80% of the eye hazards in an average industrial plant with a full eye protection program.* For full information on the glasses workers *want and will wear*, call your AO Safety Products Representative, or write for Bulletin S-1013.

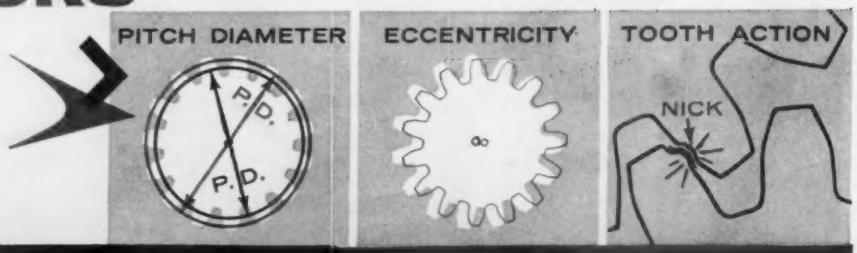
*Other types of AO safety goggles are needed to cover special hazards.

Your Surest Protection . . . AO SURE-GUARD Glasses

American Optical COMPANY

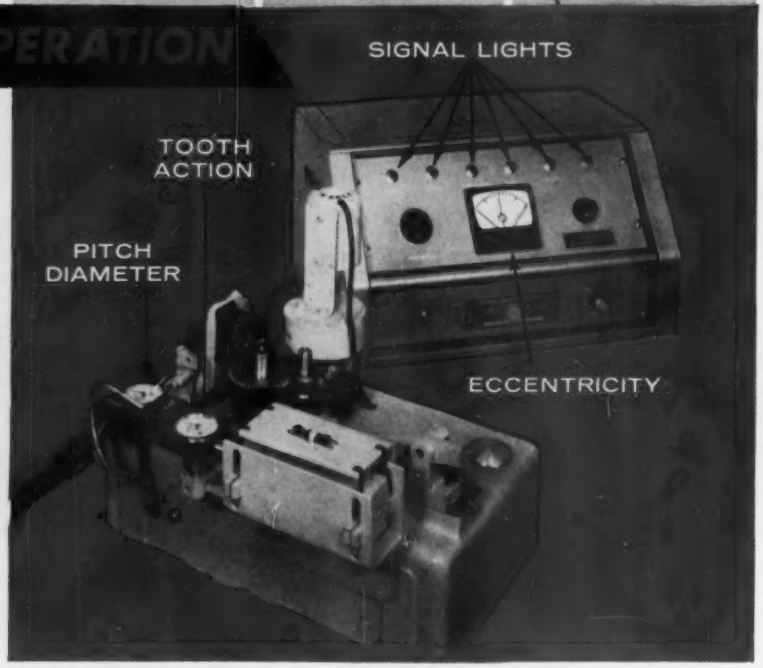
SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

CHECK INDIVIDUAL *and* COMPOSITE ERRORS



in just ONE OPERATION

Fussy gear specifications studded with hostile tolerances need no longer foul up your inspection program



now, all readings flash on simultaneously

The New Red Ring Inertia Gear Analyzer speeds inspection 80% to 90% over conventional methods— and with laboratory precision

UP TO 500 GEARS PER HOUR

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE COMPANY

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Welded Tube Adds Space

As part of its $3.5 million expansion program, Welded Tube Co of America, Philadelphia, has scheduled a 50,000 sq-ft, $300,000 addition to one of its factory buildings. New, enlarged structure will provide 100,000 sq ft for the processing and warehousing of raw steel stock and finished welded tubing, in addition to the areas occupied for manufacturing. The company has previously spent $1.7 million for improvements and new equipment during the past 12 months.

Vulcan Materials Expands

Continuing its program of diversification, Vulcan Materials Co, Birmingham, Ala, manufacturer of building and construction materials, has purchased National Safety Engineers, Birmingham producer of highway, street, and traffic signs. It operates, in addition, an aluminum treating and painting department and a steel stamping department, both of which will be retained by Vulcan.

Allvac Metals Co . . .

. . . Monroe, NC, manufacturer of special metals, is installing new equipment worth $800,000. This will include a 5-stand rolling mill (company currently has two single mills which will remain in operation) and a highly specialized melting furnace with capacity of 10,000 lb, reportedly the largest of its kind in the world. Its present furnace is a 3000-lb capacity unit.

AM/MM

"Since we've had the shop noise cut down, I'm going nuts wondering if they're working out there."

Are you getting most floor absorbent bulk (not weight!) for your money?

Does your floor absorbent become saturated before it does its job?

Does your floor absorbent create new hazards by absorbing light, thus reducing needed working light?

Does your floor absorbent "mud up" with oil and water?

THERE'S A TEST THAT ANSWERS ALL THESE QUESTIONS

In less than 15 minutes in your own office, you can get all the right answers scientifically. Our Eagle-Picher representative will bring a miniature laboratory right to your desk. Compare Eagle-Picher Floor-Dry with any other floor absorbent. See which wins out on overall economy and full-range safety. Eagle-Picher is eager to face comparative tests. Write today.

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New all-wrench tool set cuts maintenance time

Snap-on

181-piece nut-turning set

SNAP-ON 5181-GS-B Set
181 tools in metal box

This SNAP-ON set is the timesaving answer for a maintenance man with a wide range of nut-turning jobs. The selection of 181 tools contains every standard wrench size from 3/16 to 1-7/8 in. Included are open-end wrenches, box wrenches, combination wrenches, flexible head wrenches, ratcheting box wrenches and socket wrenches.

Socket wrenches include handles and sockets in 1/4-in., 3/8-in., 1/2-in. and 3/4-in. square drive sizes. You get a full range of socket handles — ratchets, speeders, slide bars, spinners, extension bars.

Tool chest embodies all the best SNAP-ON construction features — full-length, piano-type hinges; reinforced channel top; easy-sliding, no-sag drawers; close spot welding for added strength; double-rolled edges for rigidity; and strong trunk handles for lifting the chest.

Got a tool problem — ask your SNAP-ON sales engineer

The SNAP-ON sales engineer is a specialist who devotes *all of his time* to the industrial application of wrenches and mechanics' hand tools. He welcomes the opportunity to help you solve your assembly and maintenance tool problems. Write us for his name or call your nearest branch. Free catalog of industrial wrenches is yours for the asking.

FOR ALL INDUSTRY

SNAP-ON TOOLS

8025-K 28th AVENUE • KENOSHA, WISCONSIN

FIELD REPORT

Harvey Aluminum Defense Order

A $6.9 million contract from the Ordnance Ammunition Command, Joliet, Ill, has been received by Harvey Aluminum (Torrance, Calif) for production of classified ammunition at Milan Arsenal, Milan, Tenn. Harvey is contract operator of the arsenal which is engaged in the assembly and loading of ordnance ammunition components.

Birdsboro to Produce Castings For Army Vehicles

American Car & Foundry Division of ACF Industries has awarded a $1 million contract to Birdsboro Corp, Birdsboro, Pa, for production of armor steel castings for the Army's new M-88 tank retrievers. Birdsboro has turned out various castings weighing from 200 to 2600 lb for these vehicles and recent installation of new electric furnaces and other foundry modernizations make it possible to produce them in accordance with strict specification requirement.

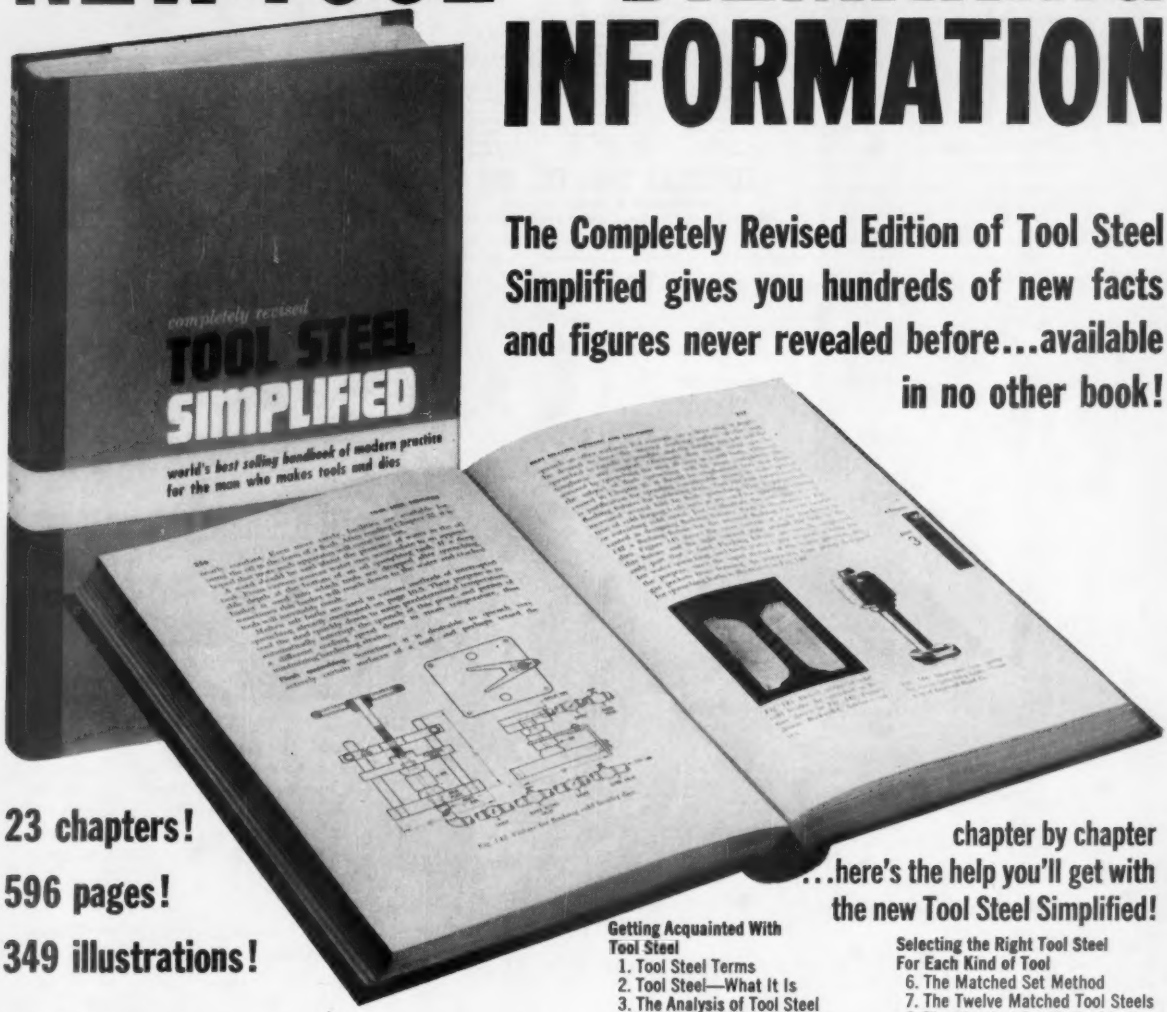
SKF Industries . . .

. . . Philadelphia, has formed an Automotive Products Division that'll market a complete line of ball bearings, tapered roller bearings, clutch throwout bearings, cylindrical roller bearings, and seals for the automotive after-market under the tradename of Nice. •

AM/MM

"I wonder if you'd mind changing your entire setup on this machine, Al—just to show this gentleman how easily and simply it's done."

NEW TOOL AND DIEMAKING INFORMATION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349 illustrations!

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Never before has one book brought so much helpful information to the tool and diemaker. Here are just a few ways in which TOOL STEEL SIMPLIFIED can help you:

- put your toolroom on a profitable, competitive basis
- reduce heat treating failures
- improve tool and die performance
- lower diemaking costs
- take the guesswork from tool steel selection
- double check your tooling procedures
- train new men faster

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Since the first edition of TOOL STEEL SIMPLIFIED was published 24 years ago, over 125,000 copies have been sold. Now completely revised, **by the original authors,** this new edition is filled with facts never published before . . . industry information geared to today's highly competitive conditions.

To advance faster in your job . . . to help your company stay competitive, order your copy now. Use it daily.

The Carpenter Steel Company, Reading, Pa.

chapter by chapter ...here's the help you'll get with the new Tool Steel Simplified!

Getting Acquainted With Tool Steel
1. Tool Steel Terms
2. Tool Steel—What It Is
3. The Analysis of Tool Steel
4. The Character of Tool Steel
5. The Soundness of Tool Steel

Properties, Heat Treatment and Testing of Tool Steel
10. Heat Treating Methods and Equipment
11. Mechanical Testing of Tool Steels
12. Properties and Heat Treatment of Twelve Matched Tool Steels
13. High Speed Steel
14. Hot Work Steels
15. Air Hardening Steels

Selecting the Right Tool Steel For Each Kind of Tool
6. The Matched Set Method
7. The Twelve Matched Tool Steels
8. The Matched Set Method in Use
9. The Tool Steel Selector

Things Worth Knowing
16. The Relation of Design to Heat Treatment
17. The Hot Acid Etch Test
18. Timbre and Hardenability Tests
19. Spark Testing
20. Furnace Atmosphere
21. The Time Required to Heat Treat Tool Steels
22. Quenching and Tempering
23. Trouble Shooting

The Carpenter Steel Company, Reading, Pa. Dept. 1

Gentlemen:

Please send me postpaid your Completely Revised Tool Steel Simplified. I enclose $2.50 ($3.00 outside U.S.A.) in full payment.

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Address_____

City_____ Zone_____ State_____

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Our inspection projector magnifies cutting edges to eliminate the minute angular deflection that could cause you costly production losses . . . just one of many inspections that account for Circle R quality.

CIRCLE R saws, slitters and combination center drills must submit to constant exhaustive inspection to work their way to you. They've got to prove they can ensure you correct cutting angles, long service, and minimal downtime.

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612-O
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CEDAR RAPIDS McNeal Tool & Supply Corp.
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DETROIT J. L. Bradford Associates
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MEMPHIS Branch-Merwin Tool Specialists
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CIRCLE 449 READER SERVICE CARD

HOW ROUND SHOULD ROUND BE IN PRODUCTION?

With dimensional tolerances on parts steadily being reduced, roundness determination is a continuing concern to manufacturing men. Here's a 12-page compendium of up-to-date opinion, advice and methods on roundness. Priced at 35¢ each, you can secure a copy by writing

Reader Service Department
American Machinist/Metalworking Manufacturing
330 West 42nd Street, New York 36, N. Y.

NAMES IN THE NEWS

DoAll Co, Des Plaines, Ill, has promoted **Donald W Mueller** (top) from chief inspector to cutting tool product manager. He succeeds **Robert Pletch** who has become director of purchasing. **Joseph Benedict** (bottom) has been named product sales manager for OEM products, special machines, and fixturing

Chrysler Corp has appointed **Chester J Quinlan** purchasing agent for body parts. He was formerly manager of purchasing for the Power Train Group which includes 16 manufacturing plants in Indiana, Michigan, and New York. **Donald E Brichta** succeeds Mr Quinlan; he was previously manager of non-production purchases for the Detroit area plants of the Group.

Kollsman Instrument Corp has named **Orrin Berthiaume** general manager of the Elmhurst, NY, plant. He was formerly production manager at Cannon Electric Co, Los Angeles.

National Castings Co, Cleveland, has elected **Kenneth L Selby** vice president and group executive of the company's Transportation Products and Capital Foundry Divisions. He was previously divisional vice president and general manager of Transportation Products.

CIRCLE 451 READER SERVICE CARD ►

ANOTHER CUSHMAN PINCH JAW CHUCK AT WORK!

Cushman has designed and engineered a complete line of both automatic and hand operated, torque controlled pinch type chucks featuring pinch units exerting gripping pressures of over 2,000 lbs. at 85 p.s.i. with workpiece lift limited to approximately .0002". These chucks are extremely adaptable to machining missile components and equally well suited for holding a range of products from rings of small cross section to large complicated weldments.

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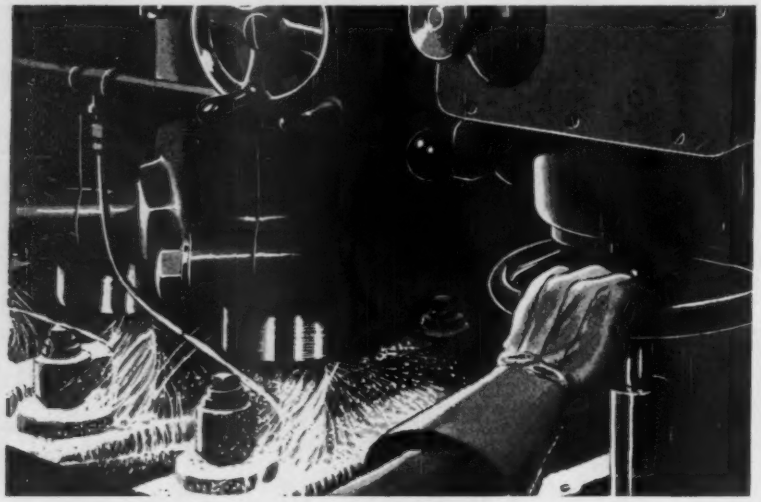

Oakite Formula 59 cutting solution fights rancidity . . . lasts longer

Most soluble oil cutting solutions are thrown out before they're worn out. When they turn so rancid that operators can't stand the smell, they're replaced. Understandable . . . and wasteful. But using Oakite 59 is far more economical. It *resists* rancidity, lasts far longer—especially in summer, helps protect workers from infection, cuts cost.

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years' leadership in industrial cleaning

United Electric Controls Co, Watertown, Mass, has appointed **Stephen T Herr** executive vice president and general manager

General Bearing Co, West Nyack, NY, manufacturer of unground bearings, has appointed **William E Horenburger** national sales manager for the company and its wholly owned subsidiary, BMB Corp. He was formerly associated in an executive sales capacity with Thomson Industries, Manhasset, Long Island.

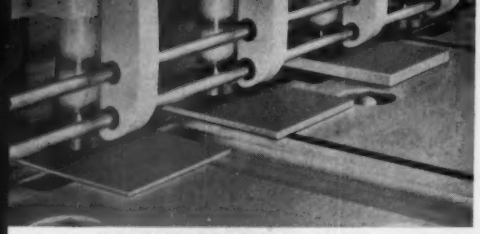
Hysol Corp, Olean, NY, has appointed **Joseph Tierney** sales manager of the Tooling Materials Division. He previously served as manager of the Olean plant and product manager of tooling products.

Firth Sterling Inc, Pittsburgh, has named **Harold A Zell** general manager of **Firth Sterling (Canada) Ltd** at Brantford, Ont. He was formerly manager of the American company's mining sales.

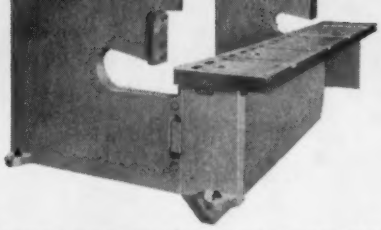
Temescal Metallurgical Corp, Berkeley, Calif, has appointed **Wolfgang Matejka** head of the high vacuum foundry department. He was previously supervisor of Kelsey-Hayes' casting department in New Hartford, NY.

Hupp Corp has named **Kenneth M Spurgeon** general sales manager of the **Hupp Aviation Division,** Chicago manufacturer of aircraft and missile components, gear pumps, and valve operators. Mr Spurgeon was formerly sales manager of defense products group.

United Aircraft Corp has named **Richard T Baseler** assistant engineering manager of the **Pratt & Whitney Aircraft Division.** He has been chief engineer since 1958.

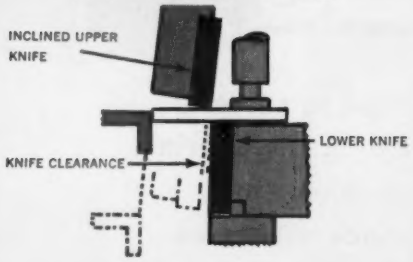


Hydraulic holddowns hold work securely.

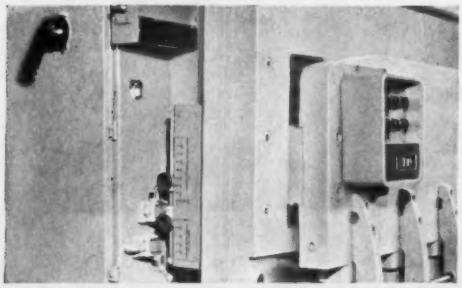


Interlocked construction eliminates load supporting welds.

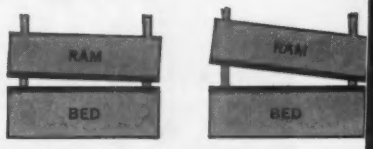
Compact manifold block replaces usual piping.



Inclined ram makes use of four edge knives practical.



Centralized controls improve operator's productivity.



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NAMES IN THE NEWS

Parker-Kalon, Clifton, NJ, manufacturer of tapping screws and related items, has appointed **R H Morley** general manager in charge of manufacturing. He was formerly assistant to the president

Metal & Thermit Corp, New York, has appointed four group vice presidents. **H E Hirschland** will head the Commercial Development and Research Divisions; **B W Weber** will be in charge of the Manufacturing and Administration Divisions; **J L Oberg** will handle the Minerals, Ceramics and Welding Divisions; and **D W Oakley** will be in charge of the Chemicals, Coatings and Plating Divisions.

Columbia Tool Steel Co, Chicago, has elected **Adolph Joseph Scheid** president to succeed **Arthur T Clarage** who has retired as president and chief executive officer. He will serve as board chairman. Mr Scheid, associated with the firm since 1948, has recently been serving as assistant to the president.

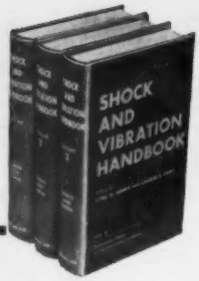
Newton Hydraulic Tooling Co, Auburn, Mass, manufacturer of hydraulic clamps, has appointed **Albert S Rairden** general manager. He was previously general sales manager of the Wire Rope Division of Wickwire Spencer Steel.

Scherr-Tumico Inc, St. James, Minn, manufacturer of precision measuring tools and instruments, has named **William M James** vice president, sales. He was previously general manager of Scherr-Tumico New York Co.

MB Electronics, New Haven, Conn, has named **John R Baker** general manager of the Manufacturing Division which does precision machining work for missile, aircraft, and general industrial firms. He was previously director of planning for MB.

NEW

From McGraw-Hill



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Here is a 3-volume library of tremendous scope for engineers who must control or minimize shock and vibration. Only in this one authoritative source will you find *all* the information you need to apply *all* major aspects of shock and vibration to engineering problems. It more than covers vibration theory fully . . . it also details the most practical, specialized phases. Fundamentals, descriptions of apparatus, explanations of methods, practical examples, and useful data are presented in a wealth of detail.

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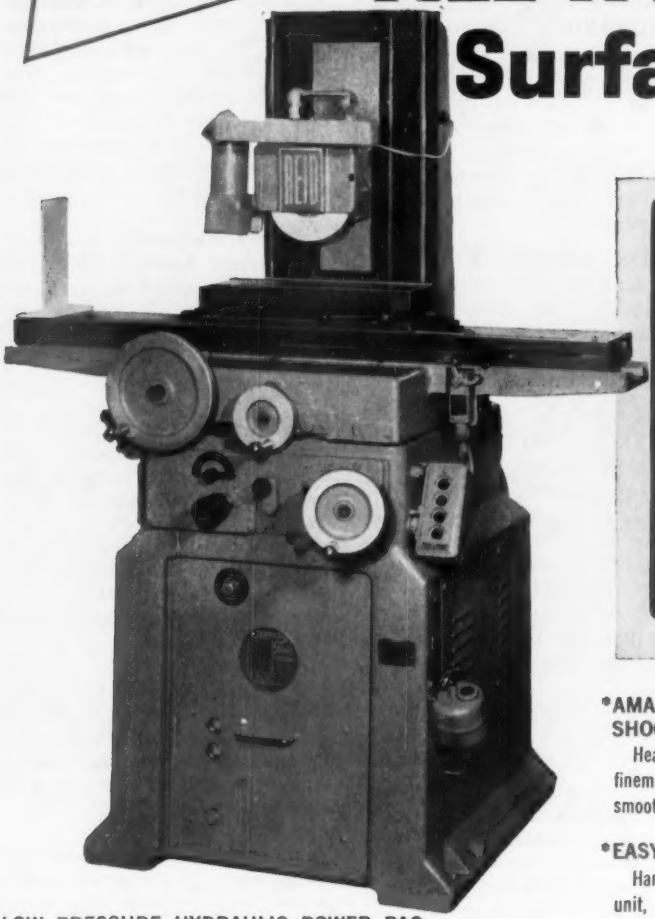
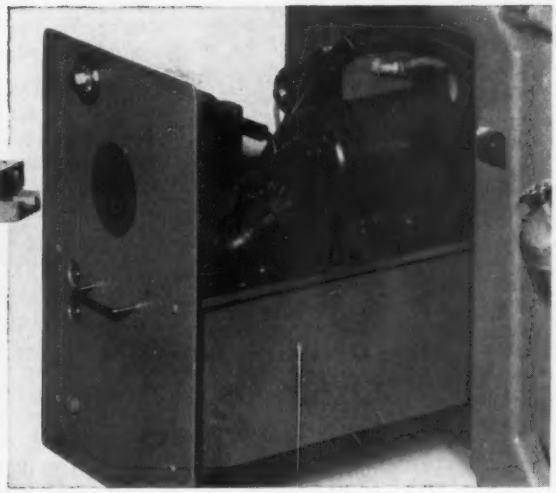
NEW REID-O-MATIC 618 HYD ALL-HYDRAULIC Surface Grinder





***LOW PRESSURE HYDRAULIC POWER PAC**

Reid engineers, in consultation with the famed UNITED ENGINEERS, have developed a special **low pressure** hydraulic power pac with double pump and electric valve controls to give this new Reid-O-Matic the ultimate in surface grinder smoothness and accuracy.

The double pump provides separate hydraulic circuits for table and cross slide motions. An automatic "sensing circuit" automatically sets the hydraulic system at only the pressure needed for any given load. The system is also designed to prevent troublesome air pockets. You'll have no delays, no need to bleed the lines.

***INSTANT POWER-TO-HAND CHANGES**

The 618-HYD features instant power-to-hand shifting of table and cross feed. Operator can switch to any combination of hand-to-power — instantly, by the flick of levers — with no need to stop the grinder.

***AMAZING SMOOTHNESS . . . SHOCK-FREE TABLE REVERSAL**

Heavy 2500 pound weight, extra wide base, and engineering refinements in the hydraulic system, give the new grinder exceptionally smooth operation and shock-free table reversal.

***EASY MAINTENANCE**

Handy slide-out hydraulic unit, simplified piping, simple electrical unit, special dust clean-out portholes, sight gauge hydraulic tank, and many other features make the 618-HYD very easy to maintain.

***PLUS ALL THIS!**

Variable Table Speed to 125 fpm . . . Automatic Cross Feed Increments from 0 to .250 . . . Two-Speed Rapid Traverse Cross Slide for fast wheel dressing and positioning . . . One Shot or Automatic lubrication . . . famous REID Finger-Tip Controls.

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REID BROTHERS COMPANY, INC., BEVERLY, MASSACHUSETTS

Compare Index Units! FERGUSON "PROVES OUT" . . . Point by Point.

Selection of components for a production machine should be based upon the machine's return per dollar investment. Matching "first costs" only does not generally result in the design of profitably operated equipment.

Here is a check list for comparison of indexing mechanisms. "Price" is shown in its order of consideration.

1. BACKLASH—None? Some during the dwell or index or both? *Any* backlash during *any* part of the cycle results in wear-causing vibrations and shock loads . . . *The Ferguson Drive maintains zero backlash at all times.*

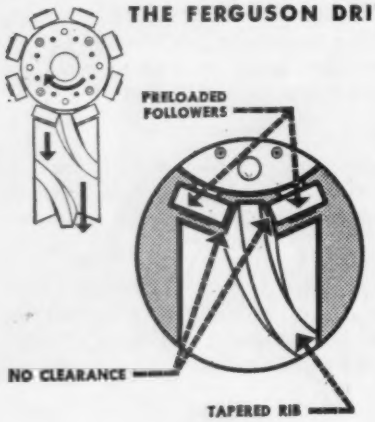
2. RATED LOADS—What is the rated life and under what load? What is the average follower life (B-10 life)? The Ferguson Drive is rated at maximum precision for at least 8,000 hours operation and with an average follower life of 90%. Replacement of the followers renews the life of the Drive for another 8,000 hours. Ferguson cams never wear out under rated loads.

3. JOB SUITABILITY—Can the acceleration characteristic be preselected according to job requirements or is it inherent in the mechanism or limited by the manufacturer? Acceleration of the Ferguson Drive can be chosen after an application evaluation to provide optimum operation.

4. INDEXING ACCURACY—Are time-consuming shot pins necessary for precision? . . . They soon wear and lose accuracy. The Ferguson Drive is positive locking and locating for extreme precision without shot pins.

5. FIRST COST vs. TOTAL COST—Now consider the higher production rates, better quality and much lower maintenance costs the Ferguson Drive gives you. Determine the *total cost* of the various indexing mechanisms. The Ferguson Drive has proved out . . . And you're on the way to building more profitable production equipment.

THE FERGUSON DRIVE



Cam features a tapered rib along which two standard cylindrical followers roll without clearance . . . *maintaining zero backlash during index and dwell.* While in the dwell or "work" position a straight portion of the cam rib locks the hub positively, without auxiliary locating or locking devices. *Extreme precision is inherent,* even at speeds as high as 2,000 indexes a minute!

CATALOG NO. 161 gives complete design data on nearly 100 standard indexing mechanisms, over 150 index tables and various auxiliary items. Send for your free copy . . . There's one for every design engineer.

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NAMES IN THE NEWS

The Society of Plastics Engineers has elected **James R Lampman** president of the Society for 1962. Mr Lampman is manager of **General Electric's** organic chemical engineering materials and process laboratory at Syracuse, NY. **John M Berutich,** sales engineer at **Haveg Industries,** Louisville, Ky, has been named SPE vice president, engineering; and **Richard B Bishop,** consultant and research associate at Holy Cross College, Worcester, Mass, has been appointed vice president, administration, of the Society.

Packard Bell Electronics, Los Angeles, has named **Leigh A Brite** vice president in charge of the Technical Products Division. He was formerly associated with the Aeronutronic Division of Ford Motor Co as manager of space electronics.

National Beryllia Corp, Haskell, NJ, manufacturer of beryllium oxide and other high-purity oxide ceramics, and ceramic-to-metal assemblies, has named **Adolf J Strott** vice president and manager, Manufacturing Division. **Philip S Hessinger** has been appointed vice president and manager, Research & Development Division.

Dravo Corp, Pittsburgh, has elected **L P Struble Jr** a vice president of the company and appointed him general manager of the Engineering Works Division. He replaces **R W Marvin** who has resigned.

Maas & Waldstein Co, Newark, NJ, manufacturer of industrial finishes and chemical coatings, has named **Robert B Stevens** manager of the Midwestern Division. He will headquarter at the Chicago plant.

American Measurement & Control Inc, Waltham, Mass, has named **Dr Frederick D Ezekiel** general manager. He was formerly director of research. Company is a subsidiary of **CompuDyne Corp,** Hatboro, Pa.

OBITUARY

John Woodman Higgins, 87, board chairman of **Worcester Pressed Steel Co,** Worcester, Mass, died Oct 19. One of the founders of the company in 1904, Mr. Higgins was a pioneer in the stamping field. He served as president from 1912 until 1951 when he became chairman of the board. A son, **Carter C Higgins,** is president of Worcester now. •

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CFC filters are the choice of industry because they have been proven under diverse and critical operating conditions . . . because CFC has 25 years of design engineering experience in every type of filtration . . . because, from over 4311 standard models and media, plant and design engineers can be sure they will get the best filter available, at the lowest cost.

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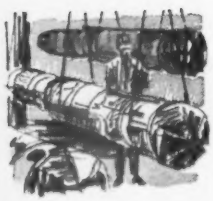

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In metalworking—men who matter read...

American Machinist / ***Metalworking Manufacturing***

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N. Y.

There are 21 basic manufacturing industries in the U.S. Government's Standard Industrial Classifications. Eight of them make up metalworking—the manufacturing of products from metal—and American Machinist/Metalworking Manufacturing concentrates its circulation (all ABC paid, incidentally) in these eight. An executive responsible for mining, ore-producing, or refining operations—or in any industry not involving metal*working*—is almost automatically excluded as a potential reader by his lack of vital interest in the subjects covered editorially by AM/MM.

AM/MM's circulation is centered in key metalworking plants in key metalworking states and is growing steadily in all eight divisions of metalworking.

Because AM/MM is read by men—manufacturing managers, manufacturing engineers and plant managers—whose sole business is making things of metal (and making them more efficiently, less expensively, more profitably), we think you'll agree it is metalworking's most powerful selling tool.

For up-to-date facts and figures on metalworking, ask your AM/MM *district manager for a copy of the Market Guide for Sales Executives.*

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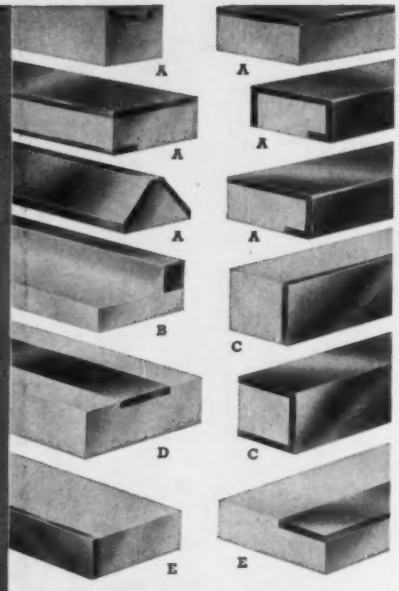
B—Composite Die Sections
C—Heel Block
D—Center Clad
E—Flange Slide



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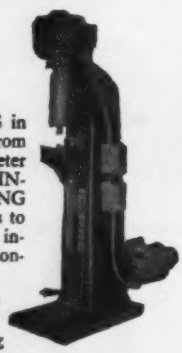

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Free Literature

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MACHINES AND ATTACHMENTS

1 TAPE-CONTROLLED TURRET DRILLS—*Burgmaster Corp, 15001 S Figueroa St, Gardena, Calif.* 16-page catalog covers 6 and 8-spindle tape-controlled turret drilling, tapping, milling, and boring machines. Four basic models are illustrated and described, and the procedure for programming work and making tape is explained. Many new features and optional attachments are pictured and discussed—these expand flexibility and adaptability of the machine to a larger class of work.

2 BORING MACHINE ATTACHMENTS—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* 12-page catalog G4A provides data on a complete line of attachments and accessories for the company's precision boring machines. Describes features, functions, and usage of 15 varied tool and workholding, indexing, and positioning devices, and cycle assists. Products and typical applications are illustrated.

3 DRILLING AND TAPPING MACHINE — *Cleereman Machine Tool Corp, Gen'l Distributor, Jackson-Fotsch Co, 7350 W Lawrence Ave, Chicago 31, Ill.* 8-page bulletin 461 provides detailed information on Series A automatic cycle units. Typical variations of the basic machine are illustrated. Table working surface is 22 x 24 in.; speeds range from 64 to 1740. Complete specifications included plus accessories and attachments.

4 25-TON AUTO-PRESS—*Havir Manufacturing Co, 444 N Cleveland Ave, St Paul, Minn.* 2-page catalog sheet illustrates and describes the new all-steel Model 25B. The automatic unit is designed for fast, long-run stamping. Includes operational information and specifications.

5 HYDRAULIC COPYING UNIT — *Cazeneuve Lathes Inc, 575 E Linden Ave, Linden, NJ.* Illustrated circular describes unit for both longitudinal and lateral copying available with the HB 500, HB 575, and HB 725 lathes.

6 DRIVING CENTERS — *Powergrip Inc, Rockfall, Conn.* Bulletin 50961 provides pertinent information on new unit. Features include reduced setup time; work is machined from end to end in one

-AU-
AM/MM

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Get all the advantages—find out how much faster—better—you can do with Inland Ledloy® steels. Go ahead...we mean it...clobber it!

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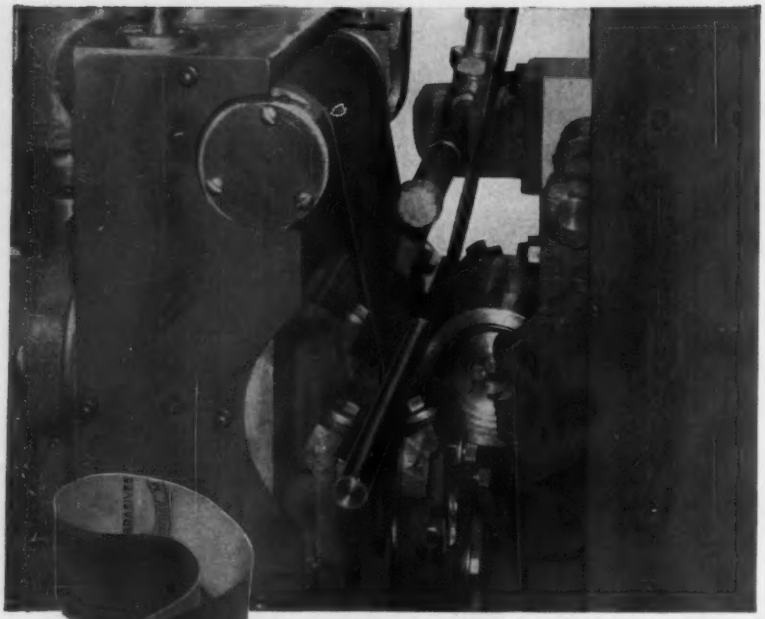
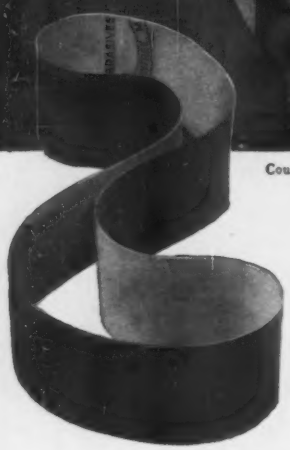
for a superior finish when centerless grinding specify Jewel Brand abrasive belts



Courtesy of Production Machine Company, Greenfield, Massachusetts



The 486 Centerless Grinder is designed for precison grinding and finishing small parts by plunge cut or thru-feed methods. It is equipped with a ground steel contact roll or a rubber faced contact roll for low micro-inch finishing.

No matter what the grinding method or the operation to be performed, there's a Jewel Brand abrasive belt designed for it. That's why experienced operators specify Jewel Brand. They know they'll get the right bond, the right backing and the right grain.
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setup; work can be loaded and unloaded without stopping the machine; work can be held without preliminary machining of the end face. Dimensions chart included.

7 EYELETING MACHINES—*Fastener Division, United Shoe Machinery Corp, Chelton, Conn.* 8-page bulletin E-103 pictures and describes each of six units including performance capabilities. Photos, line drawings, all significant dimensions and specifications and listings of both standard and optional equipment for each unit are included. Model F is able to feed and set as many as 12 eyelets automatically and features easy change of raceways and setting tools to handle different sizes of eyelets. Chart provides a condensation of United's Standardized Eyelet chart as a reference to the 65 eyelet sizes which cover most needs and for which only seven setting tools are required.

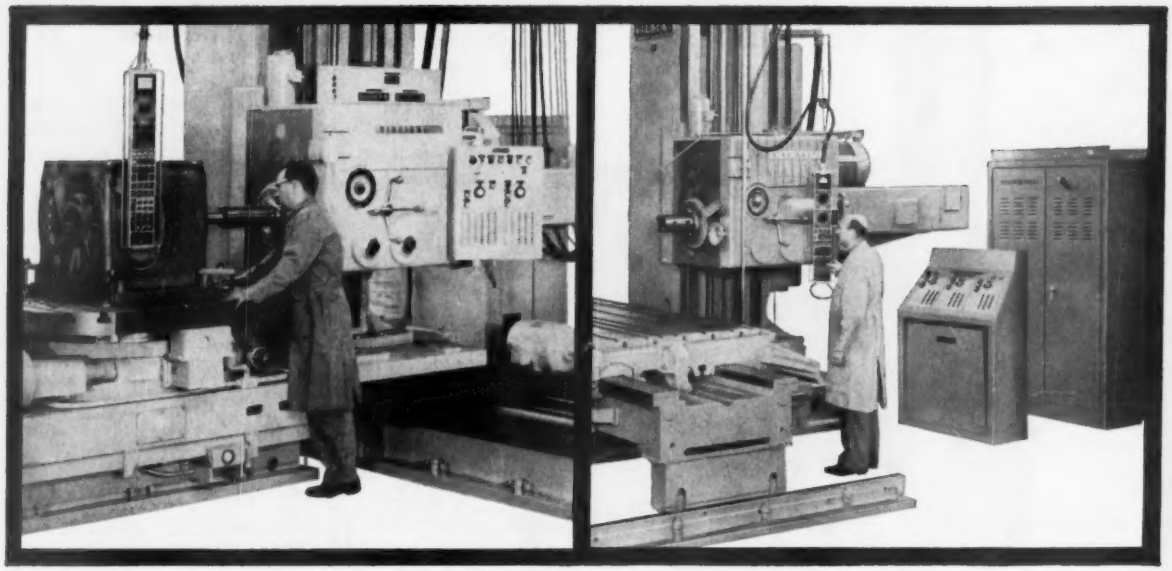
8 RADIAL DRILLS—*Boice-Crane Co, 935 W Central Ave, Toledo 6, Ohio.* Catalog sheet provides data on the Boice/Mecof. Model 25-PR's size is 8 x 30 in.; Model 35/C is 12 x 48 in. Features include single lever-controlled, 12-speed preselector gear unit; reversible spindle rotation; No. 4 Morse taper in spindle; six automatic feeds; automatic depth stop on spindle; automatic tool ejector.

TOOLS AND ACCESSORIES

9 BORING BARS — *Vascoloy-Ramet Corp, Waukegan, Ill.* 8-page catalog 6105 covers bars that combine micro-adjustable feature for accurate diameter adjustment in increments of 0.001 in. with the economies of carbide throw-away inserts. Light, medium, or heavy cuts are possible because of chip control provided by built-in, adjustable chip breaker. Bars are available in three basic styles (micro-adjustable): one with interchangeable heads for finish boring diameters from ½ to 1-½ in., one for shallow boring diameters from 1.50 to 2.20 in., and a style for deep hole boring diameters from 1.60 to 2.60 in. Four non-adjustable styles with throw-away inserts are also furnished for boring diameters from 1¾ to 3 in.

10 DRILL JIG BUSHING CONVERSION CHART—*Acme Industrial Co, 200 N Laflin, Chicago, Ill.* 4-page chart, designed to expedite ordering of drill jig bushings, is a valuable aid for

"Didn't I tell you time and again—don't cross the boss!" AM/MM



Gilbert horizontals make the most of tape

Increased output per man and machine, improved and uniform accuracy, reduced tool and fixture storage, reduced parts inventory, shortened lead time, fewer inspections—all make a tape-controlled horizontal pay for itself fast, *if the horizontal is built to work with tape.*

To get increased output, your horizontal must be basically designed (as a Cincinnati Gilbert is) to take increased operation. To get improved, uniform accuracy, your horizontal must be built (as a Cincinnati Gilbert is) to eliminate uneven wear of ways, guides, and screws.

Tape can be "tacked onto" any horizontal boring mill; but it will pay off best when it is teamed with a Cincinnati Gilbert, designed to make the most of tape.

New 4″ and 5″ series are built for tape

Both the new 4″ and 5″ series, table and floor type, are designed—from foundation up—to match the potential of tape. Exclusive LIFE-LIGN construction of ways and guides eliminates cocking of all moving units. No matter how hard you run a Gilbert under tape, you can be sure that every unit moves straight and smooth as the tape commands.

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You can get any degree of numerical control you need, from simple dial-in operation to three-axis control of the machine and automatic table indexing.

Write for new literature. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, Cincinnati 23, Ohio.

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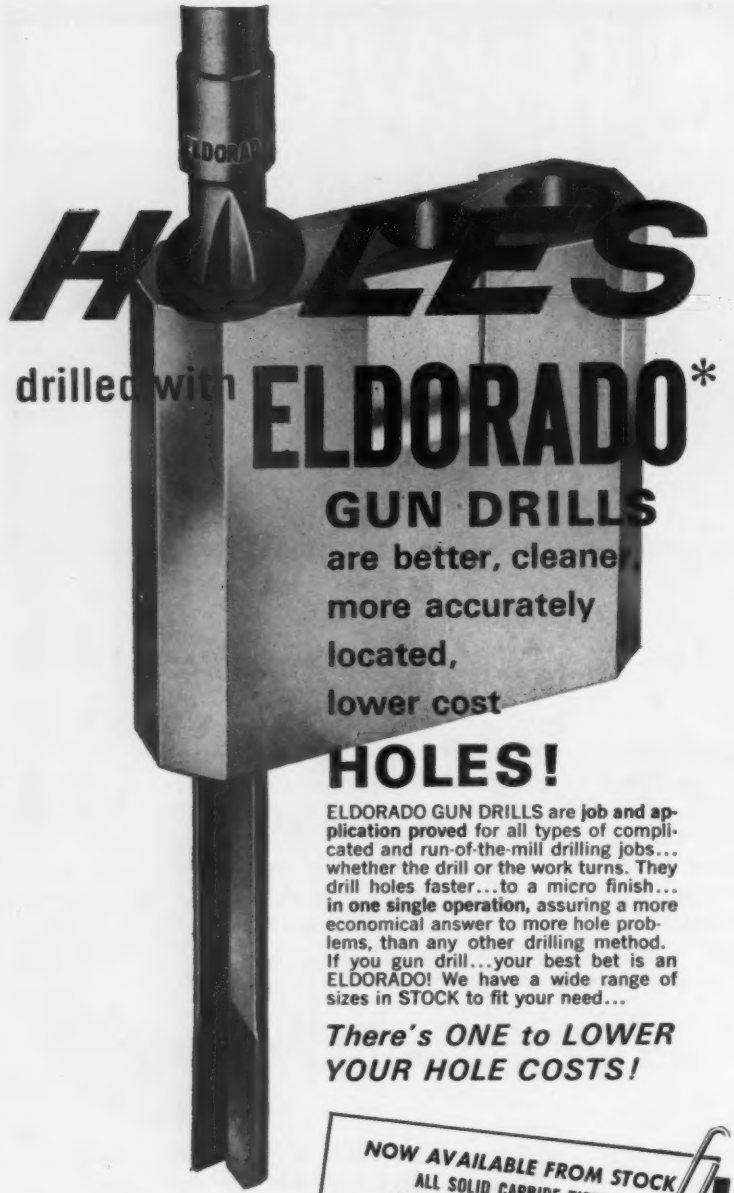

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Size-Dia.	LENGTH	Driver
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.5156" to .7500"	16", 22", 36"	1" x 2¾"
.7656" to 1.0000"	22", 36"	1¼" x 2¾"

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fixture designers, permitting the conversion of symbol numbers for easy, accurate ordering. Also included are ASA standard symbol numbers.

11 SOLID LUBRICANTS—*Alpha-Molykote Corp, 65 Harvard Ave, Stamford, Conn.* 8-page article, "Lubrication by Solids as a Design Parameter," discusses the important aspects of solid lubrication from the point of view of the original equipment designer. Boundary friction and the theory of lubrication by solids are discussed. Three principal forms of molybdenum disulfide solid lubricants are described and a reference chart gives application characteristics of the primary formulations in all four forms. Typical applications described.

12 DUAL-PURPOSE MISCOSCOPE—*Philips Electronic Instruments, 750 S Fulton Ave, Mount Vernon, NY.* 8-page bulletin PXM discusses the Norelco EM 75 electron microscope and its conversion to X-ray microscopy. Explains principles and techniques of projection X-ray microscopy; also gives special attention to the details of the target disk and outlines how the EM-75 electron microscope is easily converted for X-ray microscopy operation.

• MACHINE TOOL REPRO-TEMPLETS—*Repro Templets Inc, 814 Allegheny River Blvd, Oakmont, Pa.* 36-page supplement to its present catalog of ¼-in. scale 2-dimensional Repro-Templets on adhesive-backed film covers approximately 2000 current machine tools which have been added to company's inventory of standard catalog items, immediately available on order, for use in plant planning. Request direct on company letterhead.

13 HYDRAULIC EXPANDING ARBORS—*A & C Engineering Co, 12024 E Nine Mile Rd, Warren, Mich.* 6-page Hydra-Lock bulletin AC-100 covers arbors, chucks and gages said to eliminate chucking errors and provide positive location (accuracy on center) by hydraulic expansion of arbors and male gages and hydraulic contraction of chucks and female gages. Functions described; recommended usages are listed; applications showing both manual and automatic actuation illustrated.

14 MINIATURE SOLID CARBIDE TOOLS—*Atrax Co, Day St, Newington 11, Conn.* 8-page brochure gives application information and prices on small, very small, and miniature precision

AM/MM

"Well, go ahead! Blame our old machines—tell me they're ready to fly apart!"

NIKON OPTICAL COMPARATOR

new model 3A offers unusual screen brightness and image resolution – features zoom-condenser system

The unusual image brightness, definition and accuracy achieved in the new model 3A–to the very edge of the screen –is a credit to the quality and design of its optical system.

The new Nikon model 3A permits surface as well as contour inspection–independently or simultaneously. And controls are provided for adjusting the intensity of each of the illuminators.

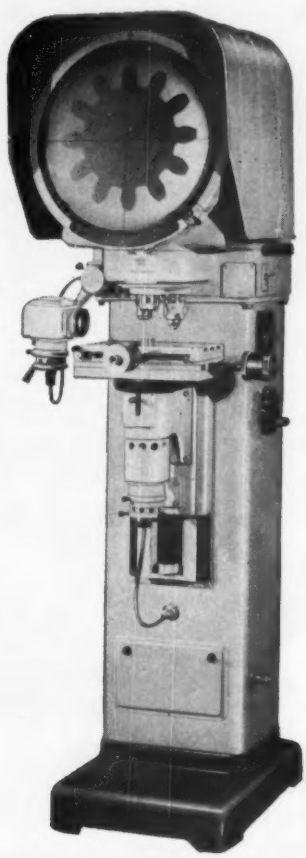
The surface illuminator may be used obliquely to emphasize surface texture. Or, for greater measurement accuracy, the surface illuminator may be used in conjunction with lens-mounted, half-reflecting 45° angle mirrors to provide shadowless light on the optical axis. Contour illuminator employs a special zoom condenser matching system. Convenient control simplifies adjustment for optimum illumination at each magnification.

Model 3A is normally supplied with a choice of one or more standard lenses in magnifications ranging from 10x to 100x. Other magnifications are also available on special order. A 3-lens turret supplied as standard equipment, facilitates instant changes. Focusing is smooth and effortless. Utilizes leadscrew drive with scraped ways and adjustable gibs.

The model 3A is equipped with a sliding hood which may be drawn out to shade the screen, or can be retracted to permit ready access to chart or screen surface. The overall diameter of the screen glass is 14½", designed for use with standard charts.

The new Nikon 3A accepts a wide variety of micrometer stages, holding fixtures, protractor screens, charts, photo attachments, and other accessories. For details write to Dept AM-11

features new 14" screen



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ground solid carbide tools recommended for electronics circuit board and instrumentation applications.

15 INSTRUMENT COUNTERS—*Durant Manufacturing Co, 1945 N Buffum St, Milwaukee 1, Wis.* 16-page catalog 400 pictures and describes line of mechanical and electrical units. Provides specifications and detailed data, discusses special applications.

16 SHEET STEEL SEPARATORS—*Magni-Power Co, Box 122, Wooster, Ohio.* 4-page brochure SS-8-61 describes and illustrates permanent magnetic units available in a line of 29 standard models. They are designed to handle steel sheets or blanks of every gage, sheet size, and stock pile height for either automated or hand production. Features include magnetic strength guaranteed for life; stainless steel guide plates for automatic elevation and separation; and special handles for carrying or swing pivot mounting.

17 CUTTING TOOLS — *Keo Cutters Inc, 2504o Easy St, Warren, Mich.* 16-page illustrated catalog covers standard tool line which includes combined drills and countersinks, keyseat cutters, arbor type keyseat cutter, cutter reamers, lathe mandrels and machine countersinks. Also illustrated are many types of special tools —long drills, special tapered shank drills, drill and spot facers, bell-type center drills.

18 CIRCUIT BOARD ROUTERS AND DRILLS—*M A Ford Mfg Co, 1545 Rockingham Rd, Davenport, Iowa.* Bulletin 109 describes characteristics, performance, sizes, and prices of carbide diamond-grind routers in addition to solid carbide drills with the new circuit board point. Illustrates function of the routers which have been especially designed for routing circuit boards, glass base epoxy, plastic, fiber, graphite, and other non-metallic materials.

HEAT TREATING AND WELDING

19 CONTROLLED ENVIRONMENTAL EQUIPMENT—*Electric Hotpack Co, Cottman Ave at Melrose St, Philadelphia 35, Pa.* 128-page illustrated catalog contains specifications, descriptions, and prices for standard laboratory, pilot

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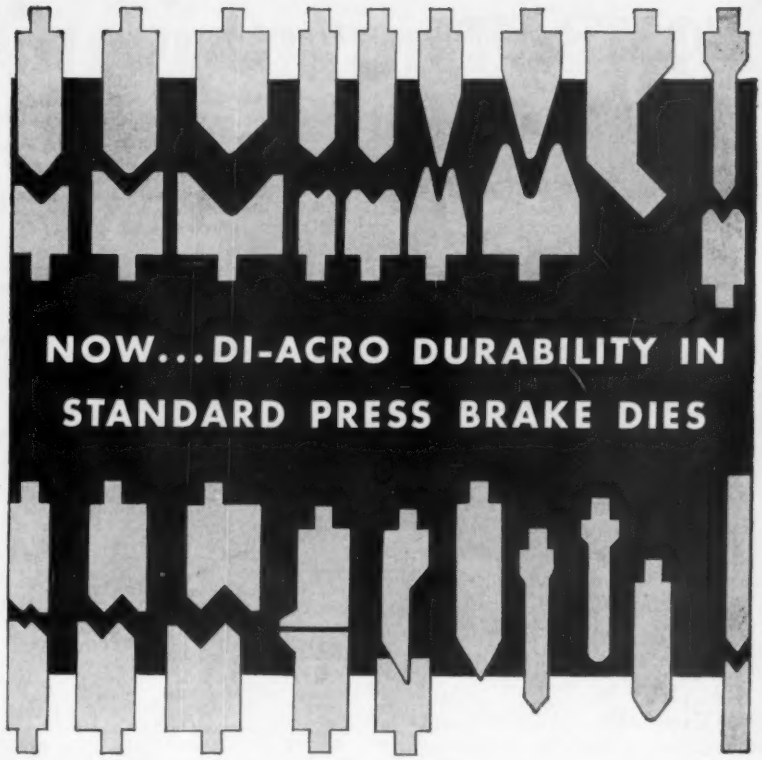
"Say, I'm new here—who do I give the plans for my outdoor furniture to?"



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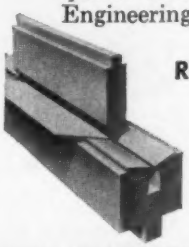
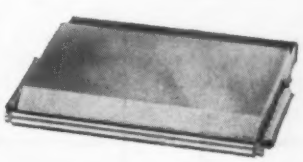


ROL-FORM DIE

One die forms materials to ⅜″ thick—all angles to 60°. Hardened and precision ground rolls pivot smoothly to fold material gently—without work marks. You save time and reduce die costs.



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Barry offers *three* different resilient elements: neoprene, helical springs or air to solve your individual requirements. These quality-engineered Machinery Mounts not only provide the ultimate in layout flexibility — they pay big dividends too — isolating shock and vibration, improving precision, reducing machine and building maintenance. Even operator efficiency goes up as noise levels come down.

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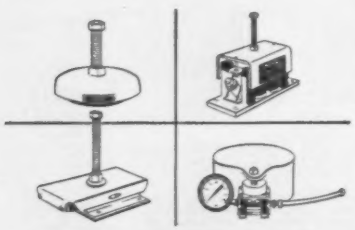

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plant, and production ovens, water baths, furnaces, walk-in environmental rooms and chambers, temperature-humidity chambers, and optional instrumentation.

20 SOLDERING IRONS—*General Electric Co, Schenectady 5, NY.* 4-page bulletin GEC-1545A describes line rated 6 to 230 v, 12 to 1250 w. Includes information on the new Penline-120 iron, 120 v, 30 to 45 w. X-ray view shows construction of tip which includes Calrod heater.

21 BOX-TYPE FURNACES—*Blue M Electric Co, 138th & Chatham St, Blue Island, Ill.* 4-page bulletin 1550 illustrates and describes both bench and floor models in new series of Stabil-Glow units which feature a high temperature electronic proportioning control system. Also includes information on Blue M Stabil-Glow bench-type muffle furnaces, Stabil-Glow industrial and laboratory floor-type furnaces, bench and floor-type Rad-O-Glow globar furnaces, and crucible or pot furnaces.

22 ELECTRIC INFRARED CONTINUOUS FURNACES — *Radcor Inc, PO Box 432, Fostoria, Ohio.* Illustrated bulletin BRG113 provides information on units for brazing, soldering, fusing, enameling, and annealing. These portable, self-contained conveyorized models give work temperatures to 1400 F.

23 WELDING, SOLDERING, BRAZING PRODUCTS—*All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY.* 4-½-page folder is designed as a handy reference to specialty products. Fluxes are featured in a special section, and a new No. 430 stainless solder kit is described. Other sections cover electrodes for cast iron welding; a range of copper and bronze alloys for welding and brazing; Spoolarc alloys for aluminum welding; and a product grouping for solders and silver alloys. Alloy selection charts included.

24 ATMOSPHERE BOX FURNACES —*Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill.* Illustrated bulletin 1087 pictures and describes Type GB-50 with a chamber 6 in. wide, 12 in. deep, and 5 in. high, suitable for heavy and continuous duty at all heat levels up to 2500 F. Type GB-50AC36, also described, is identical with GB-50 but is equipped with a cooling chamber and is designed for manual pusher operation.

AM/MM

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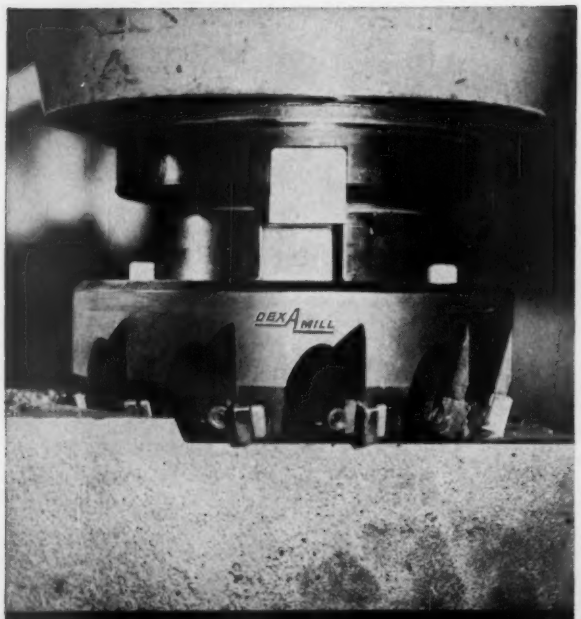
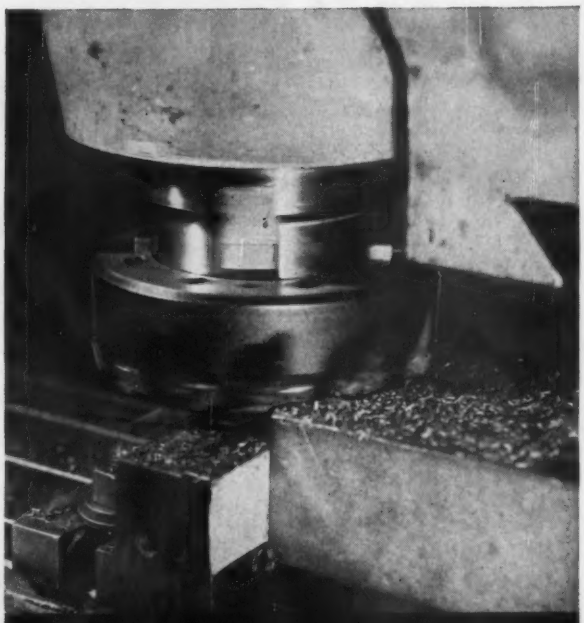
...FOR OUTSTANDING MILLING EFFICIENCY ON CAST IRON...

NEW GRADE AM



FOR ROUGHING . . . A Midwestern manufacturer of engines, power units, tractors and trucks, using an 8" Adamas Dex-A-Mill with Grade AM inserts on cast iron, takes a 6" wide cut ⅛" to ⅜" in depth at 300 sfm . . . feed per tooth .010" per revolution.



FOR FINISHING . . . An Eastern manufacturer of typewriters and data processing systems uses a 6" Dex-A-Mill with Grade AM inserts on cast iron to take a 5" wide cut ⅛" in depth at 500 sfm . . . feed per tooth .001" per revolution . . . work finish 40 rms.

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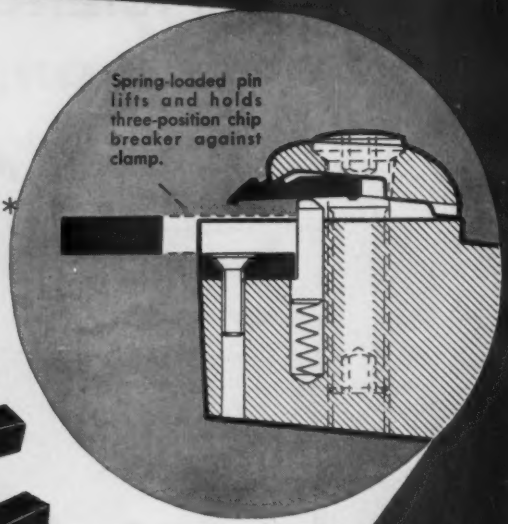

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FULLY ENCLOSED DRIVE . . . improves safety factor by eliminating exposed rotating parts. Front guard shields operator from oil splashes.

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PLANT SERVICE EQUIPMENT

25 DIRECT-FIRED MAKE-UP AIR HEATING—*Mazon Premix Burner Co, Muncie, Ind.* 8-page bulletin AS-62 traces the need for replacement air to compensate for that exhausted to remove dusts, fumes, vapors, and other contaminants from process equipment; distinguishes between make-up air heating and space heating; lists and illustrates the necessary components and makes suggestions on system layout. Gives detailed technical data on efficiencies, allowable concentrations of combustion products, and effect on relative humidity.

26 "THE HOW AND WHY OF NOISE CONTROL"—*H H Scott Inc, Instrument Division, Dept P, 111 Powdermill Rd, Maynard, Mass.* 16-page booklet discusses fundamentals of industrial noise control. Shows how to set up a program to achieve safe and efficient working conditions. Equipment required is described.

27 CHAIN LUBRICATION—*Oil-Rite Corp, 2386 Waldo Blvd, Manitowoc, Wis.* 8-page manual, bulletin 1800, presents general recommendations and suggestions for lubrication of power drive chains as well as conveyor and elevator chains. Specific methods of chain oiling are discussed ranging from plain manual brush-type lubricators to completely automatic systems, as well as spray oiling and forced feed lubrication for high-speed chain drives. Chain cleaning is covered and suggestions made. Miscellaneous applications and installations illustrated.

28 INDUSTRIAL METAL CLEANING —*Daubert Chemical, Nox-Rust Division, 4700 S Central Ave, Chicago 38, Ill.* 12-page booklet discusses factors involved in selection of a cleaner, cleaner equipment, and compares advantages offered by various types of cleaners commonly used.

29 INFRA-RED HEATERS — *Panelbloc Division, Bettcher Manufacturing Corp, 2106 West 61st St, Cleveland, Ohio.* 16-page application manual PE-2-61 covers infra-red heating in detail; describes body heat loss and methods of controlling such loss. Descriptions are given of full heating jobs and spot heating. Two general methods for calculating requirements are explained. Tables, graphs, and engineering drawings are included.

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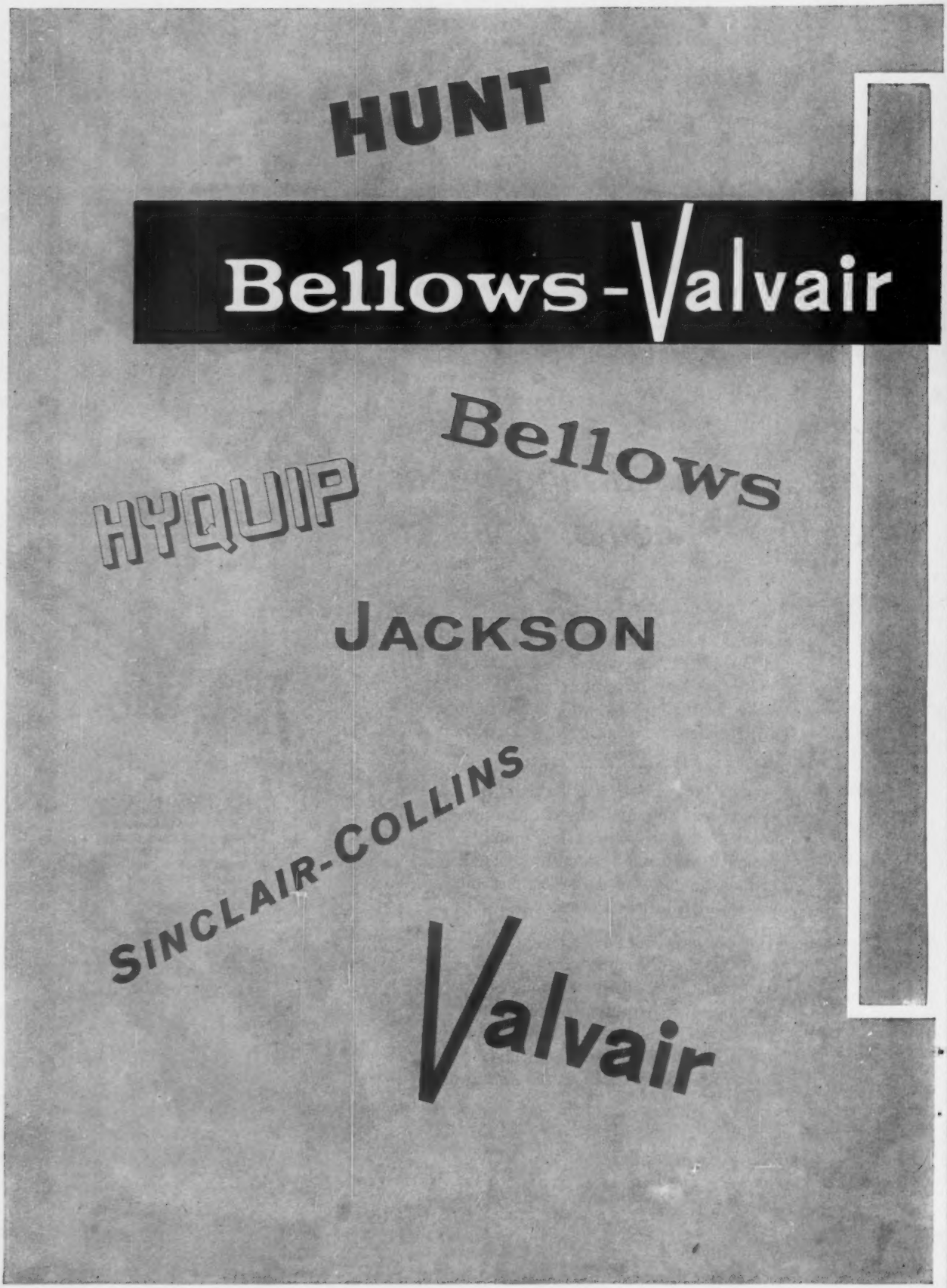
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Consolidation of all sales and service under the name Bellows-Valvair combines the knowledge and experience of over 300 design, production and field engineers. The resources of this group are at your service, ready to aid you in the engineering and application of pneumatics, hydraulics and electronics, to solve your production problems.

1196-C

New Bulletin FP-62 will give you more information on the divisional product groupings. For your copy, contact the field office near you (listed in the Yellow Pages and Thomas' Register, Volume IV), or write to Bellows-Valvair, Akron 9, Ohio, Dept. AM-1161.

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For { 8-STATION PRODUCTION MACHINING
1½" BAR AND COLLET WORK
CHUCKING
SINGLE POINT THREADING

Costs { $7,525.00 FOB Factory Complete with all standard equipment

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading.
Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret.
The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

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For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.

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Write for bulletin with complete specifications and tooling data

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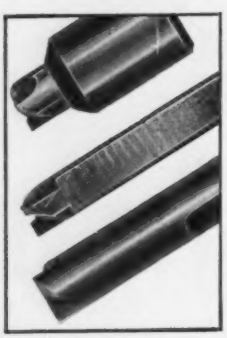

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Bldg. 32
349 Lincoln St.
Hingham, Massachusetts

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

30 METAL FINISHING EQUIPMENT —*Kelite Corp, 81 Industrial Rd, Berkeley Heights, NJ.* 4-page illustrated bulletin P-9613 describes the chemical compositions and equipment supplied by the company. Among the chemical applications covered are aluminum processing, electroplating, phosphatizing, rust removal, rust and corrosion inhibition, in-processing cleaning, and paint stripping. Steam cleaning and phosphatizing are discussed in detail.

31 CONVEYORS — *Standard Conveyor Co, North St Paul 9, Minn.* 4-page brochure, "Conveyorama," pictures variety of ways to cut costs with conveyors. Illustrated are a new, simple type of low-accumulation-pressure live roller; clamp-type carton stackers; high-speed continuous vertical lifts; and a complete system for ordering and dispatching small items from remote multi-floor storage areas.

PARTS AND MATERIALS

32 MINIATURE PRECISION BEARINGS—*Miniature Precision Bearings Inc, Precision Park, Keene, NH.* 64-page indexed catalog 6, a spiral-bound, plastic-covered handbook, is a complete compilation of engineering information on the subject. Includes new sizes (actually beyond the miniature range up into the so-called instrument bearing size range), and several new types of bearings not previously cataloged—some of the derivative types of the M series high-speed bearings, and the end-cap and integral shaft types. Sections are included on nomenclature, failure analysis, allowable misalignment, tolerances.

● STAINLESS STRIP — *Superior Steel Division, Copperweld Steel Co, Carnegie, Pa.* 32-page illustrated brochure on company's stainless strip steels provides a guide to correct selection of various stainless grades for specific applications. Data on analyses, physical and mechanical properties, heat treating, and finishing of 19 types is provided plus visual presentations of applications. General cleaning procedures for fabricated stainless products, and weight tables included. Request direct on company letterhead.

33 BEARINGS—*T B Wood's Sons Co, Chambersburg, Pa.* 12-page bulletin 7104 covers all sizes and styles of Life-Lube permanently lubricated, ball-bearing pillow blocks, flange units, and take-up units as well as porous-bronze and babbitted pillow blocks. Includes a full page of babbitted bearing information on load ratings and maximum shaft speeds. New items described are two-hole flange units in shaft sizes from ½ to 1-7/16 in.

34 SERVO-CONTROLLED PUMPS—*Oilgear Co, 1571M W Pierce St, Milwaukee 4, Wis.* 20-page bulletin 47740 introduces complete line of electrohydraulic servo-controlled pumps and system components. Describes in detail how the pumps and components work, what functions they perform, and where they are applied. Operation of one and two-way variable delivery pumps in capacities up to 108 gpm and 3000 psi illustrated and described. Covers typical control systems for simple open and closed circuits, multiple command, position control, and pressure control.

35 MINIATURE INSTRUMENT CLAMPS — *Sterling Instrument, Division of Designatronics Inc, 17 Matinecock Ave, Port Washington, NY.* 40-page pocket-size catalog 66 contains diagrams, specifications, and OEM list prices for over 150 different types. Book is divided into 10 clamp categories.

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NEEDLE ROLLER
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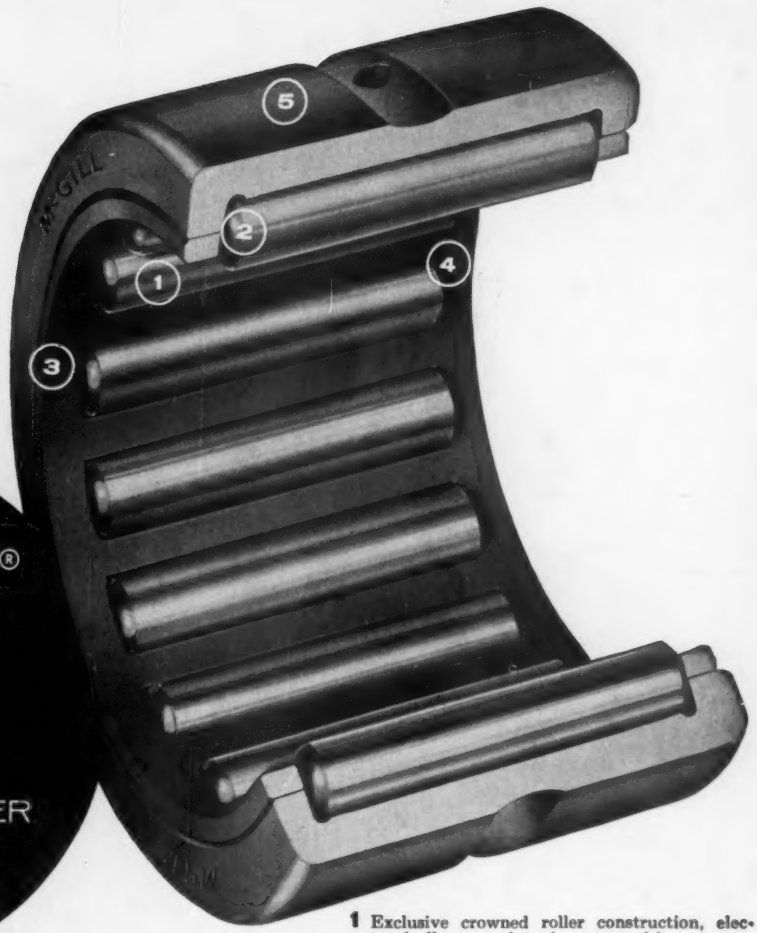

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1 Exclusive crowned roller construction, electronically gauged to insure precision contour and size uniformity. Relieved ends assure even load distribution.

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3 Proper guidance assured by tapered retainer pockets. The design insures *balanced* roller support and eliminates corner wear from edge loading of straight pockets where retainer OD and pitch circle are coincident.

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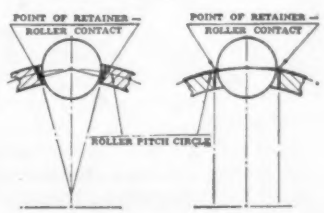

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engineered electrical products

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precision needle roller bearings

New—
CARMET'S 700 Series Cutting Grades and the fine art of making chips

Some people baby their carbide tools. They hold back a little on roughing cuts, because they've heard carbide is pretty brittle . . . and some of it is. Or they ease off on finishing cuts, because their tool may be too soft for long, fast passes . . . because it may wear or crater. And, some of it will.

But this is "paring-knife" machining, and it really isn't necessary. Not any more . . . not since Carmet introduced the 700 Series Steelcutting Grades. No paring knife made these chips . . . these were hogged out on a production basis by one of Carmet's new carbides . . . Grade CA-720.

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Carmet's 700 Series have the edge wear and crater resistance, *and* the ability to endure shock and heat, to breeze through jobs like this. They're doing just that all over the country . . . right now! Next time you're setting up a mean, tool-buster of a cut, let the 700 Series make chips and money for you, just once. Your Carmet Distributor has the local stock and all the information. Call him, or write:
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Bliss Big "C" Inclinables whisper where others shout . . . and it's an important reason why their owners are getting more parts per hour, closer tolerances, fewer rejects, and longer die life.

Why? Because noise is simply audible vibration and, the less the vibration the less the wear and the less the rejects.

The designers of the Big "C" licked this vibration problem before it started. They did it with such things as achieving precise fit of all moving parts, balancing of the rotating parts and by using quiet running helical gears on geared presses. Then, they relied on the massive cast Meehanite frame to dampen what little vibration remained.

The result was, as people like Victory Metal Manufacturing Corporation, Plymouth Meeting, Pa., know, a vibrationless press that gives more parts per hour with fewer rejects. Victory, the world's largest manufacturer of commercial refrigerators, has four Bliss "C" series inclinables in day in and day out use giving longer die life and slashing production costs. How about you? If your press requirements include inclinables—or another type—demand Bliss—it's the "profit" press for you.

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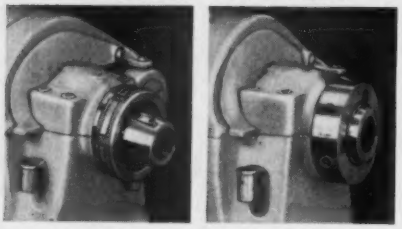
Tolerances don't dictate slow-ups when you are using these precision lathes. Their accuracy, smoothness and operating ease save time as well as material on the tough jobs. With proper tooling, work can often be machined with such precision and smoothness that subsequent grinding, honing or lapping operations may be eliminated. Dollar-for-dollar you get more in South Bend Lathes. Write for catalog now and find out how South Bend Lathes can lower your machining costs.

OPTIONAL FEATURES



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Hardened—Ground Bed Ways to resist wear and scoring under severe conditions.

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Send literature on ☐ 14½" Lathes, ☐ 9" to 16-24" Lathes, ☐ Turret Lathes, ☐ Milling Machines, ☐ Shapers, ☐ Drill Presses, ☐ Pedestal Grinders.

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36 EPOXY RESINS COMPARISON CHART—*Mitchell-Rand Manufacturing Corp, 51 Murray St, New York 7, NY.* 4-page folder compares 17 Randac epoxy resins, their components, primary uses, handling characteristics, and physical and electrical properties.

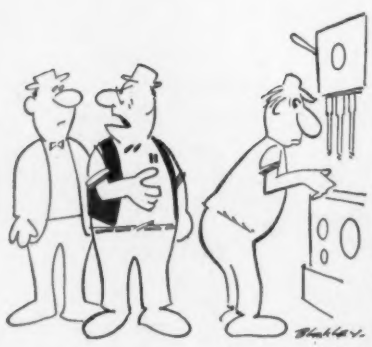
37 "THE HOLE STORY"—*Aluminum Co of America, 731 Alcoa Bldg, Pittsburgh 19, Pa.* 12-page publication details material cost savings of from 10% to 26% when Alcoa aluminum hollow screw machine stock and mechanical tube are used in preference to solid stock. Tabular data outlines machinability and corrosion resistance ratings, mechanical properties and specifications of the various alloys, and range of sizes and alloys offered.

38 VALVES AND CYLINDERS—*Rivett Lathe & Grinder Inc, Brighton 35 Boston, Mass.* 4-page brochure features air or hydraulic models in the 1000 standard Rivett line. Covers keeper ring and tierod designed cylinders and hydraulic directional and functional flow valves. Mounting styles and connections, such as pipe, flange, or subplate mounted are illustrated.

39 FASTENERS—*Tinnerman Products Inc, PO Box 6688, Cleveland 1, Ohio.* 32-page bulletin 359 illustrates and describes Speed Nut line. Applications pictured and engineering data supplied. Section included on multiple-function fasteners.

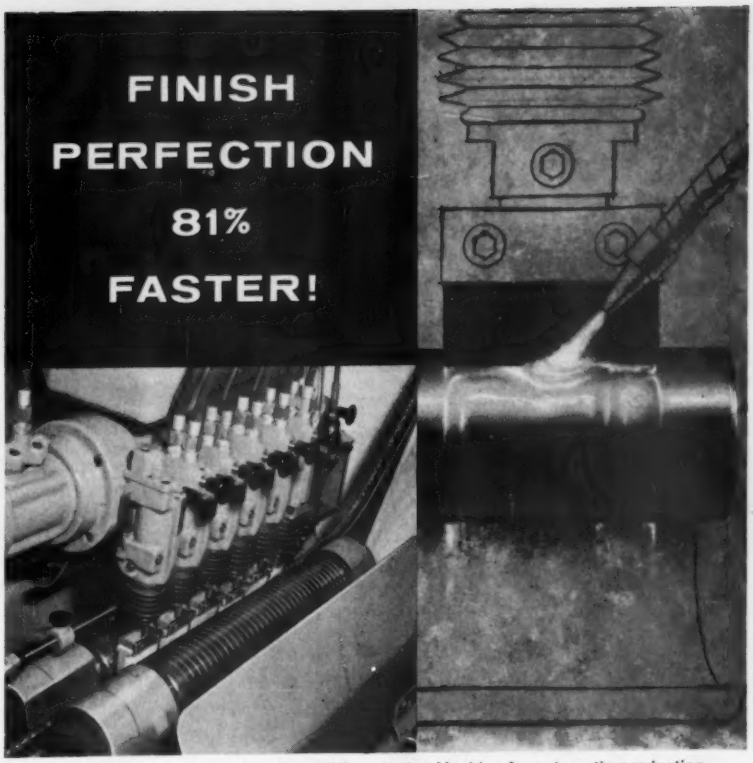
40 VALVE SIZING—*Jordan Valve, 6013 Wiehe Rd, Cincinnati 27, Ohio.* 4-page technical paper, "A Practical Look at Valve Sizing," tells exactly what appears in undersized, oversized, and correctly sized pressure reducing applications. Dangers of mis-sizing are pointed out in a typical example.

41 CHEMICAL AND METALLURGICAL PRODUCTS — *Foote Mineral Co, 18 W Chelten Ave, Philadelphia 44, Pa.* 12-page catalog of company's products lists lithium chemicals, metal and minerals, electrolytic manganese, zirconium, welding grade products, and steel addition agents for applications in the chemical, metallurgical, ceramic, electronic, nuclear, and astronautic industries. Applications and analyses given.



AM/MM

"Harry here is a part-time worker—only works when I'm around!"



Model 88 Through-Feed Centerless Microstoning Machine for automatic production and Microstoning head of the Model 9681 Microstoner, for attachment to lathes and other machine tools.

Microstoning Produces Controlled Microinch Surfaces Fast, Precisely, Profitably

Remarkable but true . . . operations are eliminated with Microstoning. You get results at least equal to — but usually much better than — you get with costly, time-consuming precision machining, grinding and handwork. And you get these results in the shortest possible time: One company cut finishing time from 30 hours to 4 hours, another from 30 seconds to 5 seconds!

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Ask your Taft-Peirce agent to demonstrate how you can *improve quality* while *reducing costs* with Taft-Peirce/Supfina. Or write for detailed information.

Finish it with

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330 West 42nd Street, New York 36, N. Y.

Free Literature

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42 GEAR DRIVES—*Foote Bros Gear & Machine Corp, 4545 S Western Blvd, Chicago 9, Ill.* Engineering catalog contains data on line of heavy-duty enclosed helical gear drives. Includes a new, simplified selection procedure plus description of various drive accessories and their application. Also described is the new right angle drive series which is available in 45 sizes in double and triple reduction types.

MISCELLANEOUS

43 MACHINERY INVESTMENT—*Designers for Industry Inc, Manufacturing Systems Division, 4241 Fulton Parkway, Cleveland 9, Ohio.* 14-page brochure on manufacturing research and engineering discusses case histories of 1) setting up complete new manufacturing facilities; 2) revising antiquated production facilities; 3) deciding what operations to automate for greatest return; 4) analyzing the investment for an assembly machine.

44 METAL TESTING—*Oregon Metallurgical Corp, PO Box 484, Albany, Ore.* Brochure describing Oremet's technical services available for testing reactive and refractory metals gives specific information on the specialized analytical instruments and metallurgical equipment employed in each of its analytical, physical, metallurgical, and radiographic services.

45 TOOL AND DIE MAKING—*Ehrhardt Tool & Machine Co, 914 Monroe St, St Louis 6, Mo.* 4-page brochure illustrates facilities for tool and die making. Complete list of the company's manufacturing equipment is furnished including details on its late model jig borers, jig grinders, profile grinding, and electrical discharge machines.

46 SPECIALIZED FACILITIES—*Danly Machine Specialties Inc, 2111 S Laramie Ave, Chicago 50, Ill.* 12-page brochure pictures and describes company's welding, machining, assembly, engineering, and other facilities. The plant is geared to handle a complete range of manufacturing jobs from the production of small, precision parts and controls to the fabrication of machinery weighing hundreds of tons. Also describes the firm's full range of testing equipment and facilities for research and development. ●

AM/MM

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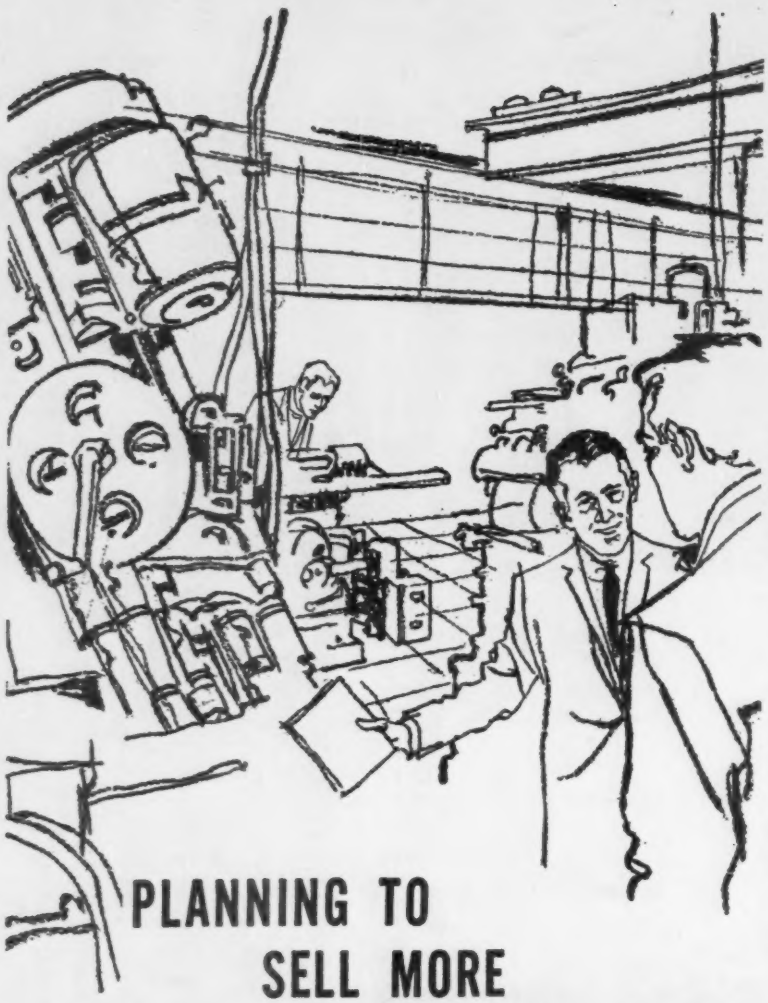
ASK YOUR KAISER ALUMINUM DISTRIBUTOR FOR YOUR 1961 ALLOY COLOR CODE CHART • NEW LEADERSHIP IN THE WORLD OF ALUMINUM



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NEW BOOKS...

AUTOMATIC DATA-PROCESSING SYSTEMS. *By Robert H Gregory and Richard L Van Horn. Published by Wadsworth Publishing Co, Belmont, Calif. 705 p. 6 x 9 in. Price $11.95*

Probably the most complete book on data processing yet to be published, this book is written strictly from management's point of view. It is non-technical and understandable, yet gives a quite comprehensive introduction to the often-misunderstood subject of data processing.

The book is very well organized. After an orientation chapter—which discusses the general ideas behind data processing and then gives a well-illustrated and easily understandable discussion of basic computer programming—the book follows with chapters on: automatic equipment, programming and processing procedures, principles of processing systems, systems design, equipment acquisition and utilization, and system re-examination and prospective developments.

Throughout the book there are pictures, sketches, and block diagrams to assist readers in their understanding of the subject matter. In addition, many simple yet illustrative examples from actual practice are spotted throughout the pages. An 18-page glossary, presented as an appendix, contains almost every term encountered in data-processing, and gives good, workable definitions filled with cross-references.

The book explains almost every aspect of data-processing clearly and logically — understandable enough for the beginner, with enough detail for the person who uses DP every day, and in a manner interesting to almost everyone who works in management. This book is virtually a must for anyone who even hears the words "data processing" during the course of his business day—JP

MINIATURIZATION. *Edited by H D Gilbert. Published by Reinhold Publishing Corp, 430 Park Ave, New York 22, NY. 306 p, 6 x 9. Price $10.00.*

The tremendous forward steps made in recent years in the development of miniature components have given rise to serious problems in design, manufacture, maintenance, and reliability. Each of these problems is discussed in this new book in rela-

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ERICKSON INSERTED BLADE

EQUALS DRILLING ACTION OF TWIST DRILL

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MORE RANGE AT MUCH LOWER COST THAN TWIST DRILLS

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Increased cross section at the cutting edge provides Greater Thermal Efficiency—Longer Tool Life than competitive blades.

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Exclusive Erickson method of grinding cutting angles gives Freer Cutting Action since end pressures are reduced.

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Restores Original Factory Grind eliminating biggest obstacle to use of Spade Drills.

All cutting angles maintained during successive regrinds to original factory grind.

SPADE DRILL HOLDERS CORRECTLY ENGINEERED

"Funnel Effect" provided in flute design to speed chip escape.

Scientific distribution of coolant over whole cutting edge.

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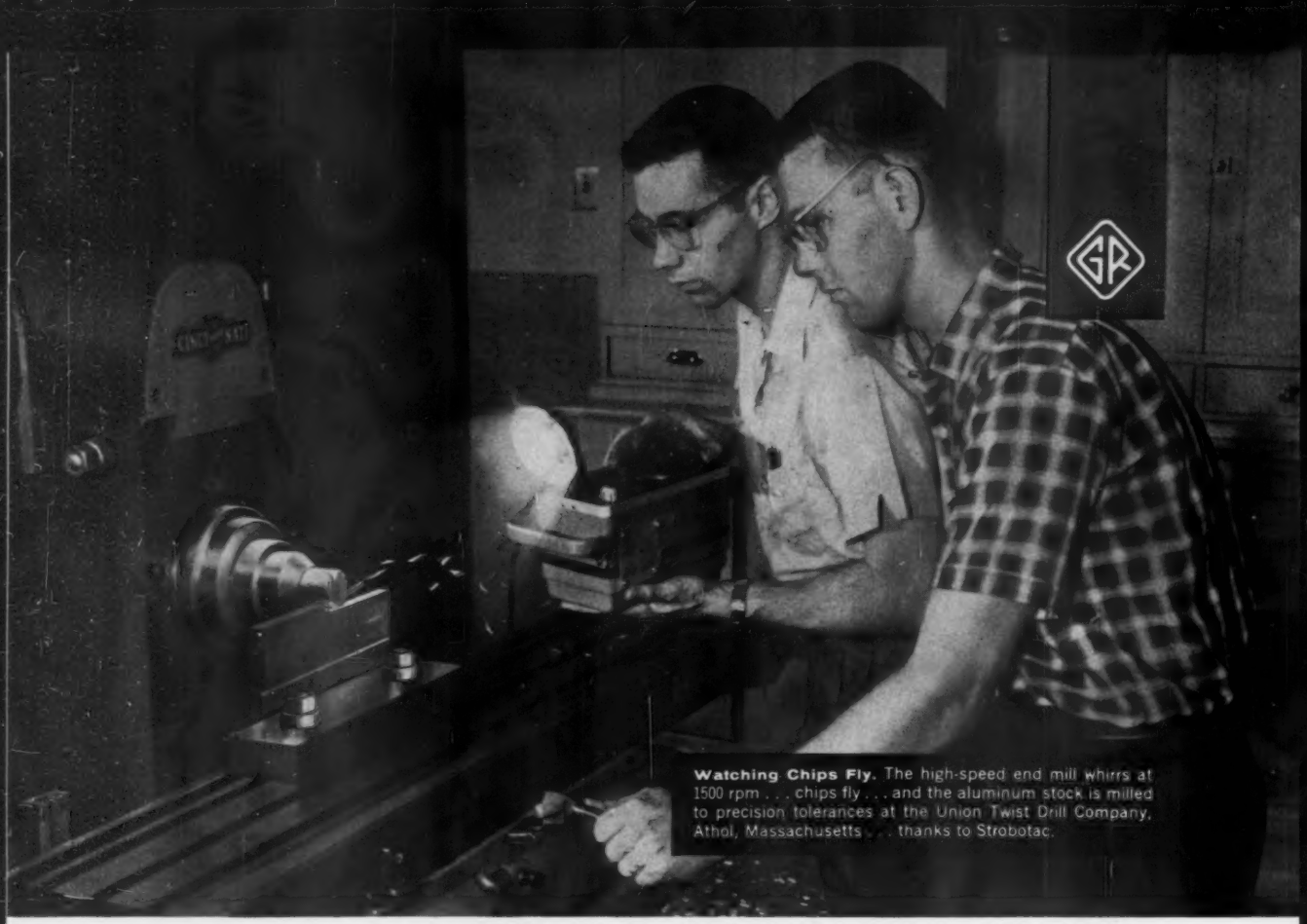

Watching Chips Fly. The high-speed end mill whirrs at 1500 rpm . . . chips fly . . . and the aluminum stock is milled to precision tolerances at the Union Twist Drill Company, Athol, Massachusetts . . . thanks to Strobotac.

Research with STROBOTAC

The new, white-light Strobotac is an important tool for studying the effect of geometry variations in cutting tools. Chip flow can readily be observed. "Stopping" the cutter with Strobotac enables a previously impossible view of the chip tool interface. If the chips are tearing from the milled surface, or are scraping the smooth surface in their escape, the prototype tool is redesigned to promote proper chip flow.

This is but one of the many uses for the Strobotac in dynamic testing at the Union Twist Drill Company.

Condensed Specifications for the instrument that will aid in the design and quality control of any type of rotating or reciprocating device.

Intense, White Light — more than 70 times brighter than previous model.

Extremely Short Duration Flash (1 to 3 μsec) — "freezes" motion; shows details heretofore impossible to see.

Measures Speed Directly — with better than ±1% accuracy to 25,000 rpm; useful to at least 250,000 rpm.

Long-Throw Beam — reaches into heart of complex machinery; made possible by new flash tube developed exclusively for this instrument.

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tion to the field of application of the miniature component. Missiles, satellites, medicine, computers, aircraft electronics, communications, military equipment, and consumer products all come under scrutiny and are discussed by 16 contributors, each an expert in his own field. Valuable information is included on the special requirements of miniaturization for space travel, and there is an interesting chapter on miniaturization as a new business, with its accomplishments thus far and its probable future.—HEL

SIX-PLACE LOG AND TRIG TABLES—*Published by Ottenheimer Publishers Inc, 4805 Nelson Ave, Baltimore 15, Md. 192 p, 2⅝ x 5⅝. Price $1.00.*

Vest-pocket-size indexed book lists trig, log, antilog, and log of trig functions in tabular form. In addition to the tables, there are eight pages of formulas, eight pages of interpolation, and many sections of valuable information. All tables are carried out to at least six places.
—AM

UNTERSUCHUNG DER URSACHEN DES WERKZEUGVERSCHLEISSES (*Investigation of the causes of tool wear*). *By Opitz, Ostermann, and Gappisch. Published by Westdeutscher Verag, Koln and Upladen, Germany. 64 p, 11¾ × 8¼. Paper back. Price 23.90 DM ($4.00) Printed in German.*

The experiments described in this publication were made by turning steels of four different carbon contents with two different types of carbide tools. Photomicrographs were made of the tool face and of the

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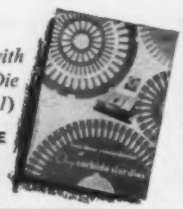

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tool side of the chip, using an electron microscope to obtain the high magnification. The method of preparing the specimens is described.

It was found that a very thin layer of the chip is heated above the transformation point, and that very small particles of iron carbide are formed. The number of these particles varies with the original carbon content of the steel. Chip and tool are welded together by cold pressure, then by hot pressure. In spite of the extremely short contact time, diffusion occurs between the steel and the cobalt of the tool.

The microstructure of the chip surface is different at the center and at the edges. Wear of the two carbide tools was different, which leads to the conclusion that machinability is not a function of the work material alone, but of the material and the tool. Surprisingly, tool wear was not the same with steels of the same routine analysis but produced from different melts, probably because of differing oxygen and nitrogen content. The influence of cutting speed on wear and on tool force was investigated. Flank wear was found to be subject to the same effects by transformation from alpha to gamma iron and the formation of iron carbide particles. The reason for build-up on the tool tip at low cutting speeds is well explained.

For studying the causes of wear on the flank, an ingenious device was contrived which removes the tool instantaneously. It also permits study of the flow near the root of the chip.

This publication is extremely interesting from a scientific point of view. The authors are scientists: they give excellent information on the causes of tool wear, but they do not tell how to avoid it.—W TRINKS

DYNAMIC ANALYSIS OF MACHINES. *By Joseph Edward Shigley, professor of mechanical engineering, the University of Michigan. Published by McGraw-Hill Book Co, 330 W 42nd St, NY 36, NY. 303 p. 6 x 9 in. Price $7.50*

Designed as a companion volume to Professor Shigley's *Kinematic Analysis of Mechanisms*, this book is written primarily for the student of engineering; however, it should make a useful addition to the practicing engineer's library.

One of the strong features of the book is that it uses the unit vector

Continued on page 288

HOW TO INCREASE COSTS A FEW DOLLARS AT A TIME

Under the guise of "cutting costs" you may save pennies while having dollars picked right out of your pocket. Just close your eyes to the productive potential of a machine. Use relatively ineffective working components and overall costs will be increased a few dollars at a time.

Cutting tools for milling machines are sometimes a good example: The purchase of the machine represented a sizable expenditure. It was justified because of the work it was expected to do, the contribution it was expected to make to the company's profit. Then someone got the

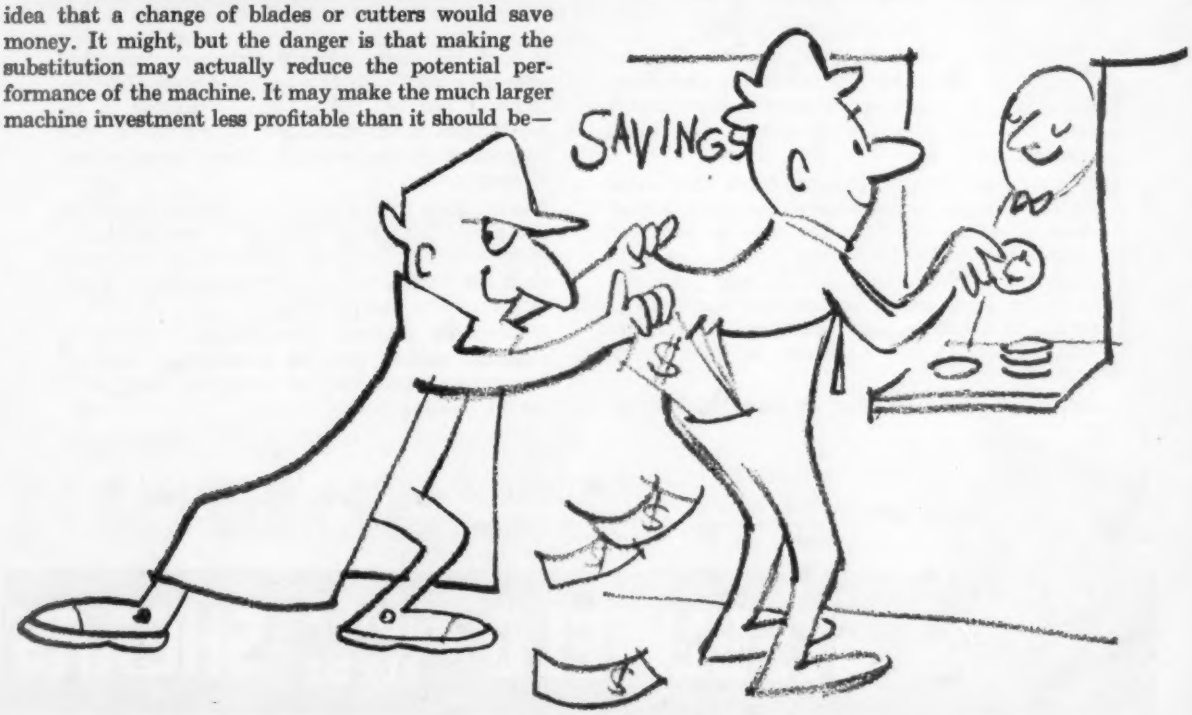
All types of cutting tools are production-run tested at Ingersoll

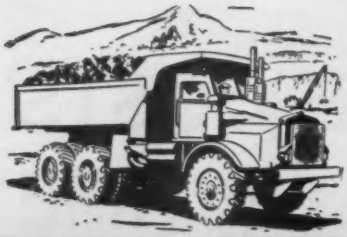
idea that a change of blades or cutters would save money. It might, but the danger is that making the substitution may actually reduce the potential performance of the machine. It may make the much larger machine investment less profitable than it should be—may *in total* increase annual overall costs, rather than reduce them. The total effect can only be known after a complete analysis of all of the factors involved.

There's a way to be sure you're NOT increasing costs a little at a time—to be sure you ARE getting maximum machine and cutter performance and minimum costs at the same time.

Ingersoll has one of the best milling cutter and blade testing laboratories in the world. It is the shop where Ingersoll builds, erects and tests special machines. Here milling cutters and blades of virtually every type and kind are continually being evaluated. The Cutter Division's blade and cutter design and manufacturing facilities are unsurpassed.

However, the true test of cost and performance must incorporate all the conditions and objectives in each user's shop. Ingersoll is equipped and prepared to help the customer determine the *right* blade or cutter for each requirement and to supply them at the *right* place and at the *right* time. Ask to have an Ingersoll sales engineer tell you about the Ingersoll Cutter Service and the Blade Back-Up Program. Write: **The Ingersoll Milling Machine Company, Cutter Division, 505 Fulton Avenue, Rockford, Illinois.**





Better Cuts Make Better Fits for Road Machinery Builder

This rugged machine is in service two shifts — 16 hours a day — five days a week shearing parts of various thicknesses and shapes for heavy earth-moving equipment. It is rated for mild steel 12' x 1".

THE ease with which good, square, accurate cuts are obtained has made the Steelweld Shear of a road machinery manufacturer very popular with the operators and shop management.

Experienced with various type shears, they know the importance of easy knife clearance adjustment. They know that the best cuts are obtained when the correct clearance is provided for each thickness of plate being cut. As they point out, improper knife clearance on any shear often results in a heavy plate being cut at an angle with respect to the thickness, or light gauge metal burring.

Adjusting knife clearance on Steelweld Shears is such an easy, quickly-performed task that operators take care of it automatically. Turning a hand crank until a gauge pointer is on the proper metal-thickness figure is all that is necessary — a task done in a matter of seconds.

The big time saving made on knife changing as compared with most shears is another factor greatly appreciated. Easily done in two hours on a Steelweld, this job frequently requires all day on other machines.

Steelweld's unusual pivoted-blade operating principle makes possible outstanding cost-cutting advantages. For the complete story, send for the catalog below.

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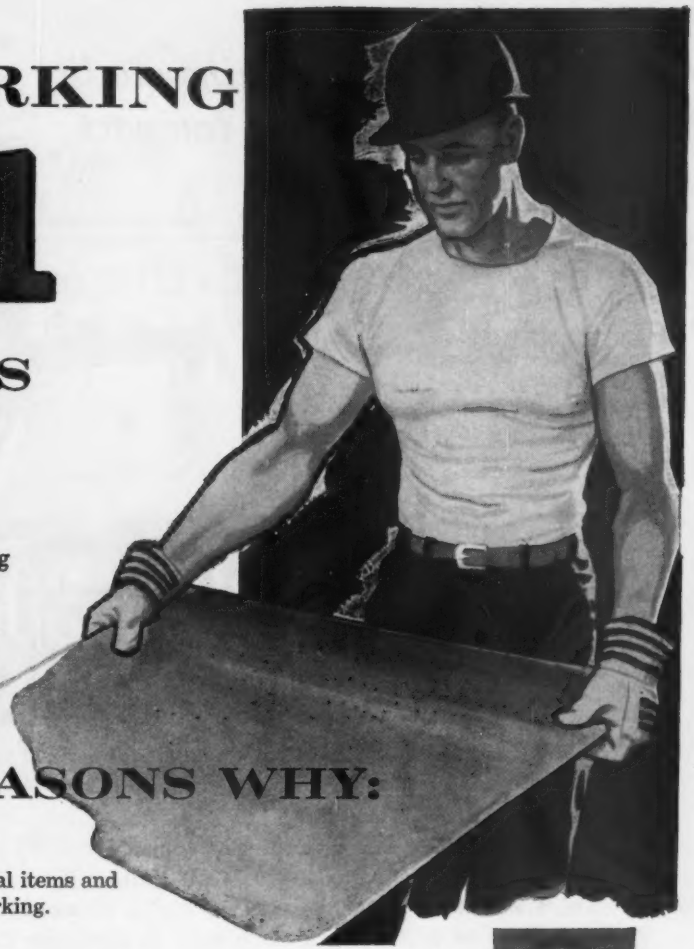

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You can do all of this with the new economical-to-buy and economical-to-use Wells Model 300 Metal Cutting Band Saw.

The Wells Model 300 gives you big 3½" x 6" rectangular capacity—up to 3½" diameter on rounds. It gives you three selective speeds, 54, 100 and 190 feet per minute, to handle a variety of metals efficiently. It features a positive screw action vise, gravity feed and automatic shut-off for horizontal cut-off work. The frame is exceptionally rigid. The entire unit is well guarded and the blade can be changed without removing a guard.

The Wells Model 300 provides exceptional value for the smaller shop or for utility work in the larger shop. It is priced remarkably low for such a well-built, well-performing unit. Ask your Wellsaw Representative for full details or write for Bulletin No. 230.

The Wells MODEL 300 Becomes Completely Mobile With Wheels and Handle

An optional wheels and handle unit makes it easy to move the Model 300 to the job to save time and money.

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approach from the very beginning. In addition, according to the author, it has attempted to treat mechanical vibrations as an integral part of dynamics; include a study of transient forces; and include an introduction to automatic control systems.

The book begins with an introduction to dynamic analysis and a review of static-force analysis. Major chapters discuss plane-motion and space mechanisms, vibration analysis, balancing, the reciprocating engine, cam dynamics, and the dynamics of feedback control systems.

Mathematics through the calculus, with some understanding of linear differential equations, is necessary for the reader. Also, because of the basic approach, a familiarization with at least vector algebra would be most helpful.

The two volumes (this one and its companion) are also available (at $11.50) in a single combined volume called *Theory of Machines*—JP

ENGINEERING STANDARDS AND APPLICATION DATA (*for fasteners*). *Parker-Kalon, Clifton, NJ. 76 p. Price $3.00.*

Newly revised and enlarged edition covers company's extensive line of tapping screws and other fasteners. Complete dimensions and engineering drawings on all head styles and standard tapping screw thread forms are included together with application and general reference data, some never before published, for 16 different types of screws.

Separate sections deal with government and military specification information; value analysis; inspection techniques for tapping screws; general plating data; and methods of measuring Phillips recess by penetration; gaging; and protusion gaging for countersunk flat head styles. •

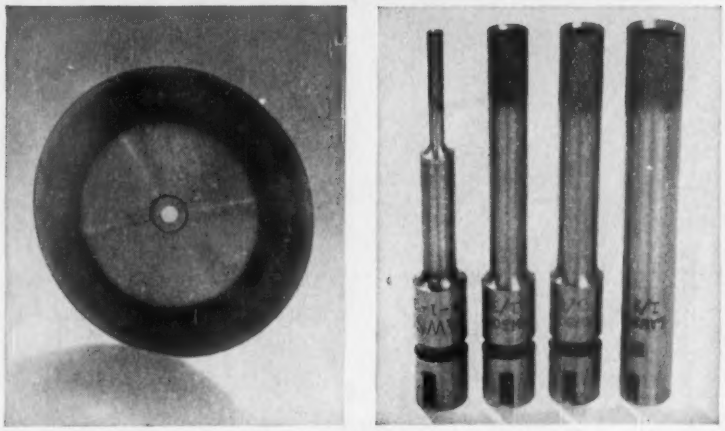
AM/MM

"Aw, come off it—I've finished jobs on time before."

Linde Coatings & materials News

LINDE COMPANY, DIVISION OF UNION CARBIDE CORPORATION

Long wear for precision cutting parts now comes in thin coatings—.001" thick



Two important industrial cutting tools whose working lives have been multiplied by LINDE Flame-Plating tungsten carbide coatings: Rubber skiving knives (l.) and paper drills.

SUPER-THIN coatings of tungsten carbide and aluminum oxide—in the .00075" to .002" range of thickness—now keep many industrial cutting surfaces on the job many times longer than previously, yet preserve the precision fit needed for optimum cutting. The result: important savings in downtime and operating costs.

These tough, long-life precision coatings are applied by LINDE's Flame-Plating process, which "blasts" molten particles of tungsten carbide onto specified areas of wearing surfaces until the particles are built up to the desired degree of thickness.

Typical examples of longer wear

Because their cutting surfaces are Flame-Plated with tungsten carbide coating, rubber skiving knives that formerly required resharpening after every shift now stay in use 15 times longer. The knives also have the advantage of a self-sharpening effect. As the softer steel base wears more rapidly than the hard, tungsten carbide coating, a sharp edge is always presented to the material being cut.

Tungsten carbide coating enables serrated knives used in cutting plastic sheeting to process three times as much material before the first re-sharpening is necessary.

A coating of .001" thickness on the inside cutting surface of surgical shears has reduced their rate of wear by as much as 33 percent.

Flame-Plating proved so revolutionary for household cutlery that the manufacturer built his merchandising theme around *"The Greatest Development in 2000 Years of Cutlery Making—a Cutting Edge of Tungsten Carbide."*

Solves many wear problems

Tungsten carbide coatings of microinches thickness are equally effective wherever metal parts or working surfaces are exposed to abrasion, galling, erosion, fretting, corrosion, or high-temperature wear. Coatings are applied by the LINDE's 6,000-degree Flame-Plating process without distortion of the work piece or changes in properties of base metals.

For full information on Flame-Plating for your particular application, check and mail the coupon below.

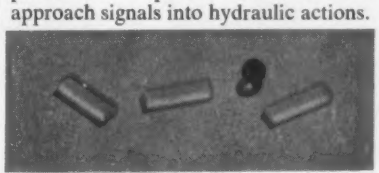
Need to production-polish tungsten carbide surfaces?

It's easy with LINDE metallographic production-polishing aluminas—available in grades for three types of finishing: For high stock removal, 1 micron C; for moderate stock removal and ¼ rms finish, 0.3 micron A; for super polish, 0.05 micron B.

LINDE has developed special techniques for production-polishing of semiconductors and soft metals (such as brass), also new ideas for production-polishing hard metals, including micrometer anvils, hardened bearing races, routine metallographic samples. Get help with polishing techniques to meet your requirements. Send coupon below.

Jet planes landed by ruby-against-sapphire wear pads

In the automatic landing computer of a modern jet interceptor, a tiny ruby ball held to tolerances of 30 millionths oscillates against a synthetic sapphire plate flat to 1/10 light band, as a reference plate for a computer to translate radar approach signals into hydraulic actions.



Approximate size: Ruby ball, sapphire plates.

A similar wear surface bears on the cam head. Certain fly wheel governors also have sapphire wear surfaces.

This 70,000 to 300,000 psi LINDE material has a hardness second only to diamond, unlubricated static friction coefficient of .18, and dynamic of .08 against itself in moderate loads. It is economically suited for wear applications such as gage points, textile guides, optical inspection flats, and flow valves. Send coupon for information.

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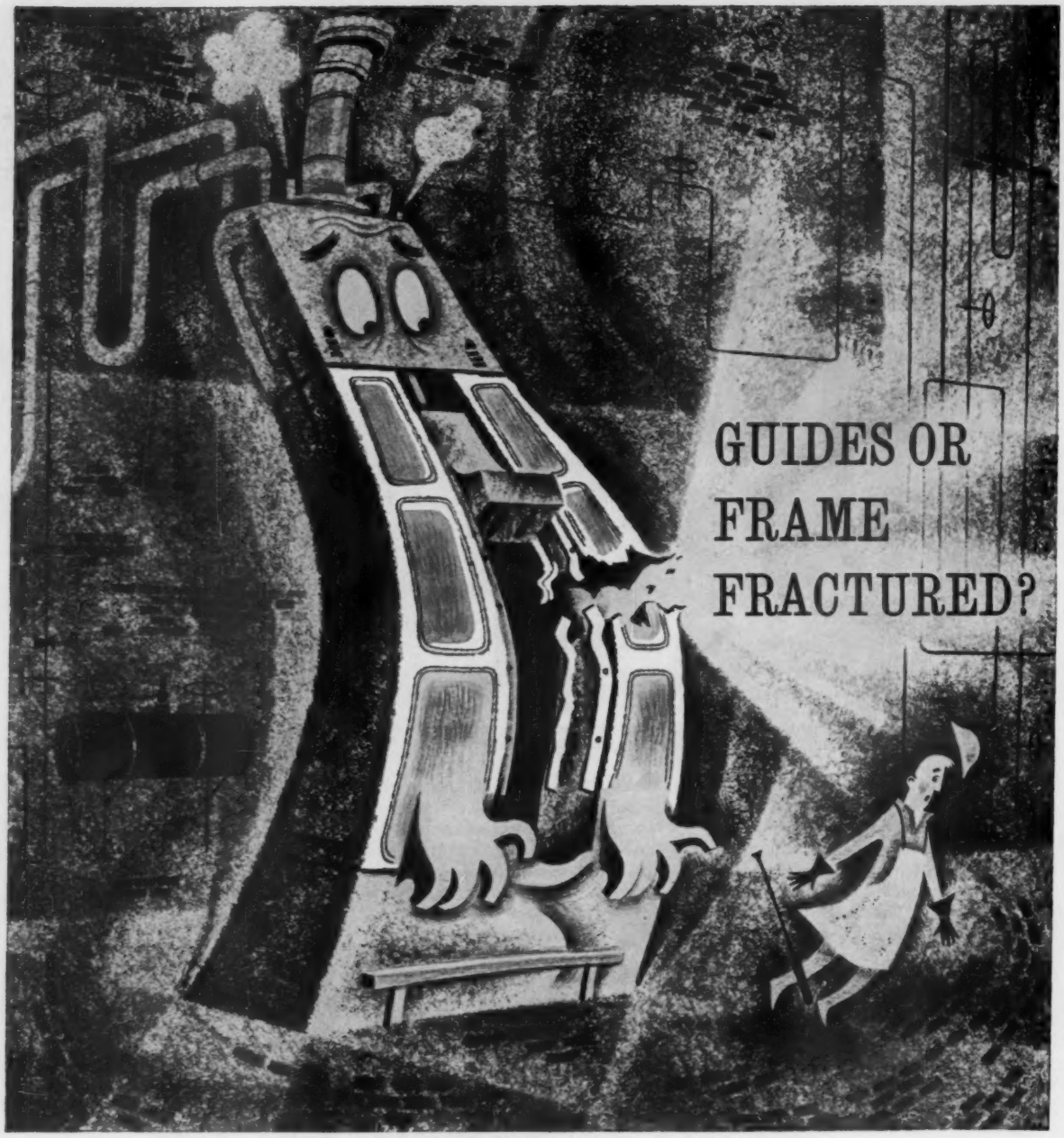

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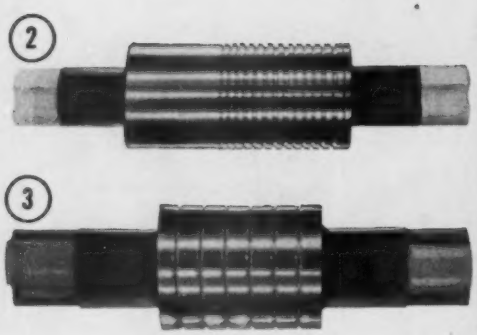

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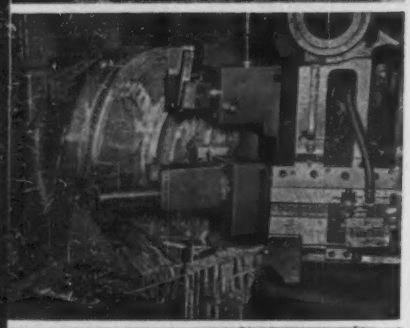

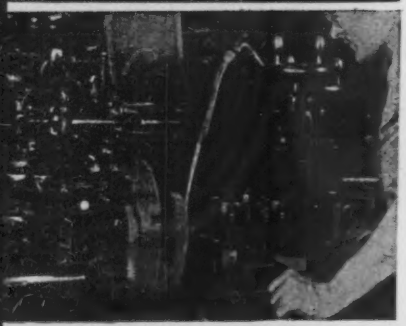

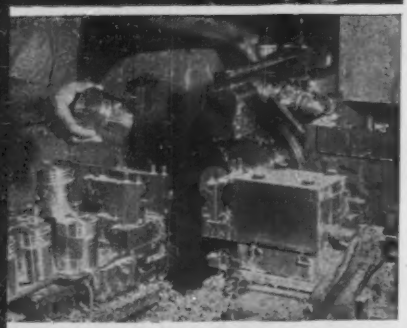

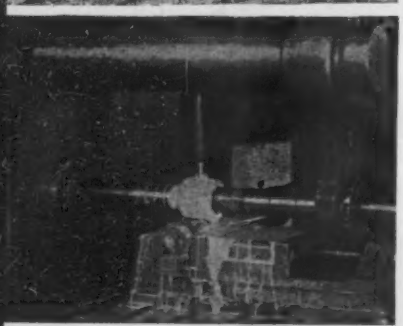

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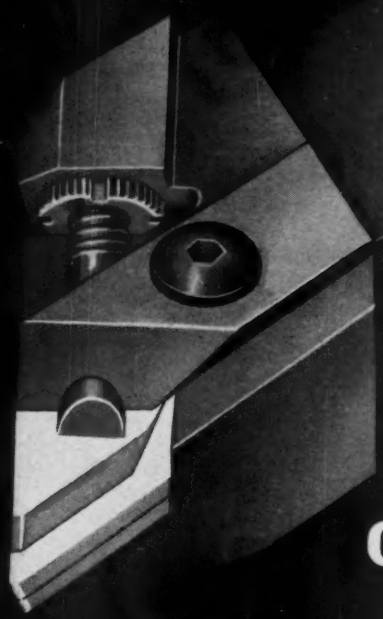


NEGATIVE RAKE TOOL

with either positive or negative rake

This new Kendex Profiling Tool offers these wanted features:

1. Available in both positive and negative rake—designed specifically for tracer lathe use.
2. Dial-A-Breaker*—for positive chip control.
3. Positive insert lock—insert *cannot* move during cutting.
4. Kendex "throw-away" inserts eliminate regrinding.

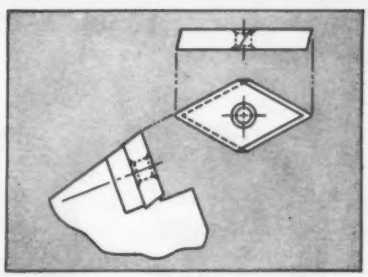
Performance proved, this new Kendex Profiling tool is available from stock in three holder styles—in either positive or negative rake. All tool holder parts are interchangeable between the negative and positive rake tools of the same hand and shank size, with the exception of inserts and shims.

The diamond shaped inserts have a 55° nose angle, suitable for practically any profiling job. The Dial-A-Breaker provides a wide range of adjustment of chipbreaker land width. It is designed to make changing, indexing or inverting the insert easy by means of a spring plunger which raises the chipbreaker when the clamp is released.

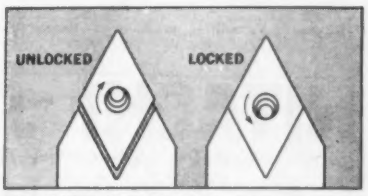
Get the complete story on this new profiling tool. Phone your Kennametal Representative or write direct to KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark 39635

INDUSTRY AND KENNAMETAL ...Partners in Progress

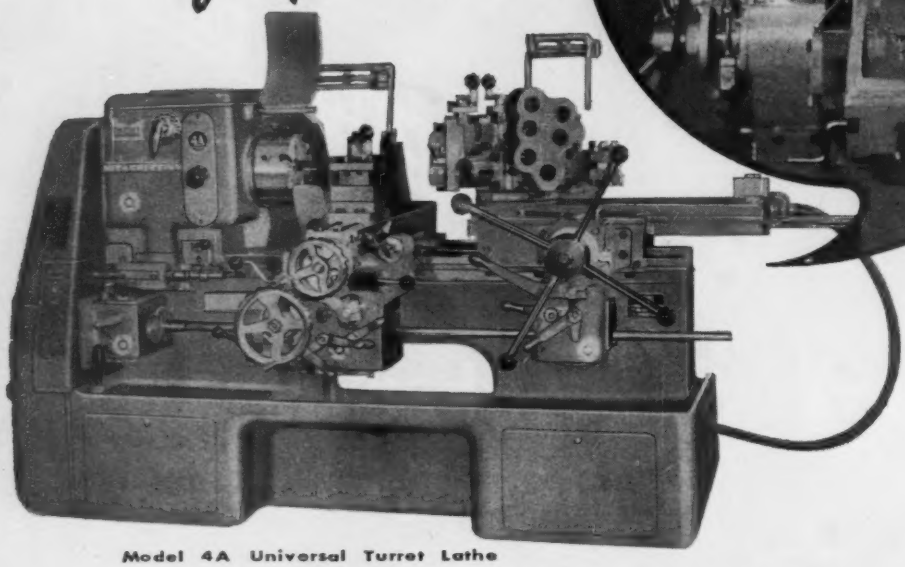


POSITIVE RAKE INSERT has reverse clearance angles on cutting edges. Dovetail recess in holder prevents insert from lifting when locked with eccentric pin.



POSITIVE INSERT LOCK — As the wrench is turned it first rotates the eccentric pin, forcing the insert back and locking it against two walls of the recess. Further rotation of the wrench locks the eccentric pin so it cannot loosen during use.

Stable Expansion —— yours with HITACHI SEIKI *equipment!*



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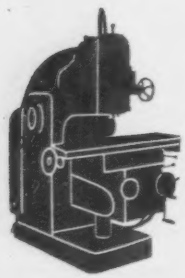
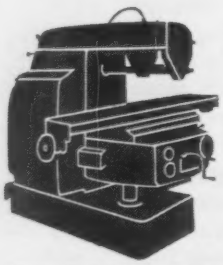
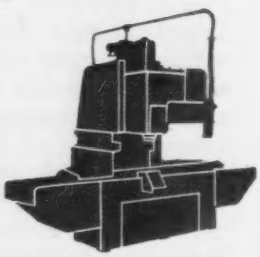


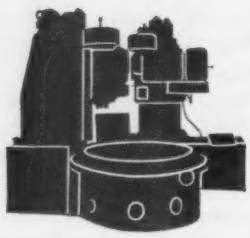
Medium Duty Milling Machine (Vertical Type)



Heavy Duty Milling Machine (Plain Type)



Production Milling Machine (Vertical Type)



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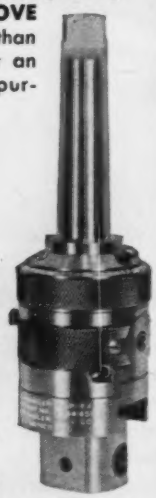

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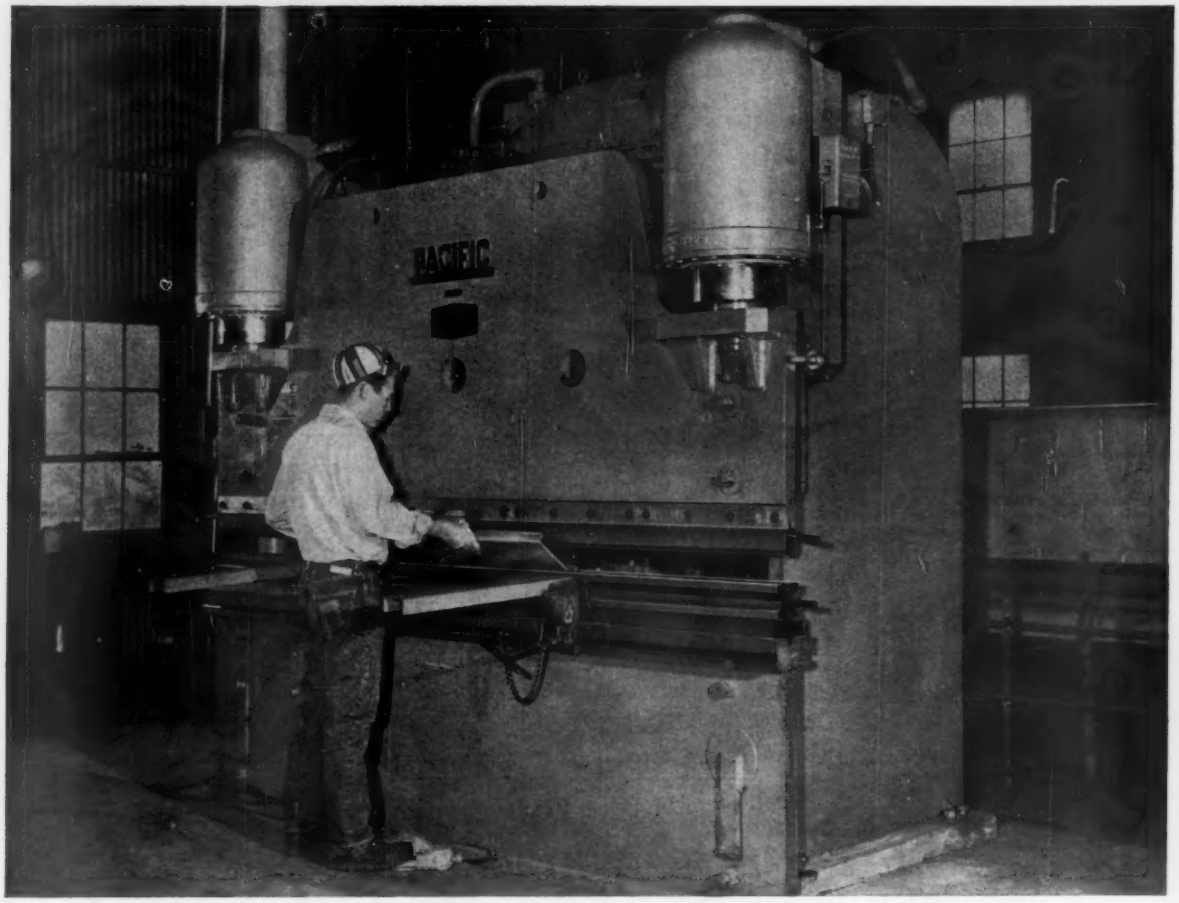

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66. Welding Equipment
69. Tools, Dressing
70. Books

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Miles Machinery Co.	302	33, 55
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Revere Machinery Corp.	301	42
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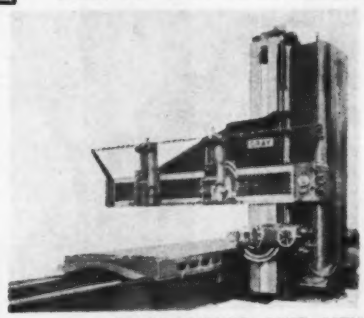

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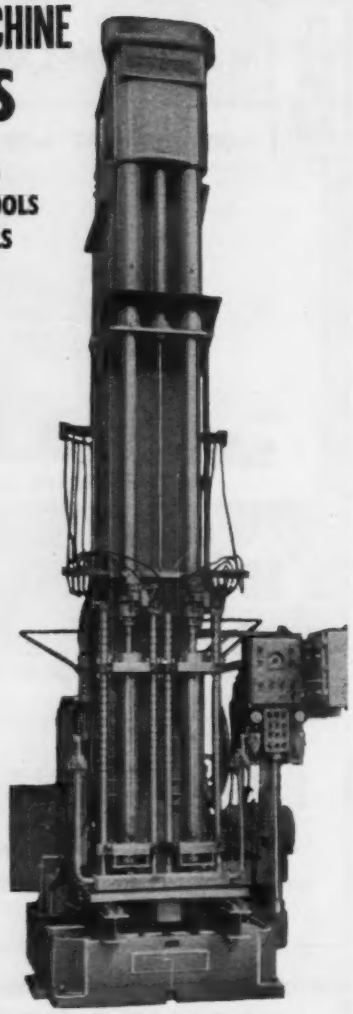

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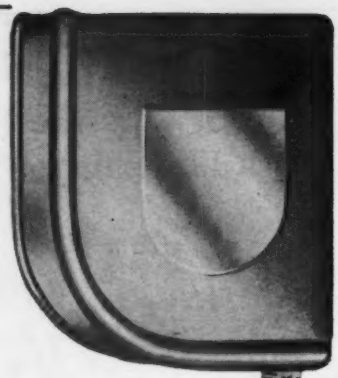

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*28" Avey 2BMA6 w/Deep Hole Attch.
*28" Colburn No. 4 MT. 5" cap. 10 HP

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*3 Spdl. Lee-Giff 5 Spdl. Base 3600 RPM 2 HP
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**24 Spdl. H-6 Natco Hydr Table ¾" U.J. (1950's)
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*4' x 11" Carleton Tp'g P. Elev., Tbl.
*4' x 11" Amer. "Hole Wizard" RBG

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**#53-2 Vinco Gear Checker Involute
*#13 Gleason Hypoid Cutter Sharpener
*#860B Mich. Gear Finisher, Microflex Counter
**#106 Gleason Gear Generator s/n 32836
*#12 Gleason Generator Dbl. Roll R & Finisher
*15" Gleason Spir. Bev. Cutter Grinder
*#00 & #1 Hamilton Hobbers

*Type A Barber Coleman Hobbers (1 long bed)
**65A3 Fellows Shaper w/access
*Type 6 Fellows #6I Shaper 35" OD Cap 1950

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**Blake Flue Grinder to ⅝" Cap
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*6 x 18 Landis Ext. w/Plunge #24473
*12 x 36 Cinc. Univ. w/Int. Spdl. RBG
**10x24 No. 4BG1 Van Norman 15° Head '55
**30x48 Landis CHW Univ Like New 1952
*#2 Cinc. Centerless, Profile Dresser RBG
*16 x 36 Landis Cyl. w/5° Head
**Wickman Microform (optional) Like New
**180 Sheffield, Multiform (1957) Like New

GRINDERS, INT.
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**1316R Bryant Hole Face & Int. 2B Spdl (1952)
*109 Bryant Int. New Spdl. (1947) RBG
*72A3 Heald TR Mod. & Sizomatic Mod.
*16-16 Bryant Chucking 1600 RPM
**#172 Heald 36" Swg. 36" Str. '48 & '50

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**15 x 54 LeBlond Dual Drive w/access.
*18 x 110 L & S w/TA, Chucks etc.
*30" x 48" Monarch Mod CM, Ser. #16526
*20 x 120 Springfield Tool'g. 10 HP RCG
*24 x 96 LeBlond H.D., T. Att. Chuck (1942)
*30 x 96 Niles "Timesaver" T.A. 3J, 4J RBG
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*#3 W&S w/Hydr. Barfeed & Tool'g RCG
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**#5 Gisholt Univ w/Chucking (1950's) RCG
*8B J&L Saddle Type 9" Bar Cap.
*1A W&S Saddle Type 900 RPM
**3A W&S with Access. 1952 & 1943
**3L Gisholt & Pressl w/CS Turret 1952
*2A W & S Saddle Type 3½" Cap B, Feed

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*36x36" Monarch H.D. w/Keller Tracer

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*4K—K&T Horiz., 18x42 Tbl. Trvl. 15 HP
**5HM—K&T Horiz. 18x94" Tbl 20 HP
**#4 Cinc H.S. D.T. Vert Mill (1951)
**2-24 Cinc Autom #50 NT Autom Quill Rter.
**85—2448 Sundstrand Rigidmill 15 HP '52
*56x96 Cinc. Hydrom., Simplex RCG
*36x36x148" Ingersoll Planer, 4 Heads
**Beam Mill, Onsrud—Tracer Controls 24'x9' table ('58)

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*16"—8 Spdl. Bullard Type D RCG

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400 Ton Cleveland Toggle Model 90T96 RBG

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**20" DoAll "Contourmatic" V. Band Hydr.
**36 DoAll H.S. Vert. Band., Hydr. Tbl (1953)

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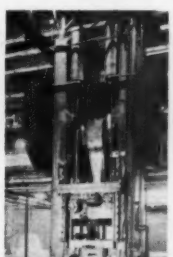

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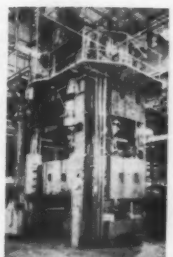

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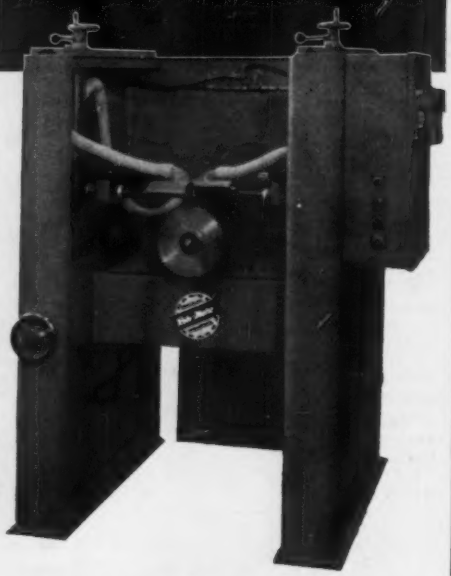

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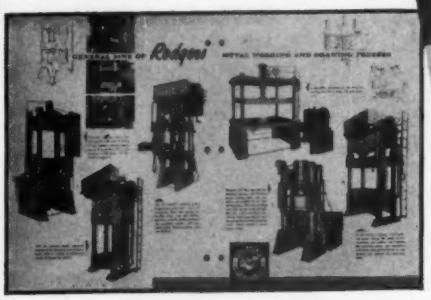

- tonnage capacities
- platen dimensions
- daylight
- platen travel
- clear span between rods
- rod diameter
- floor space
- pump type
- cylinder detail
- ram diameter
- full-tonnage pressure
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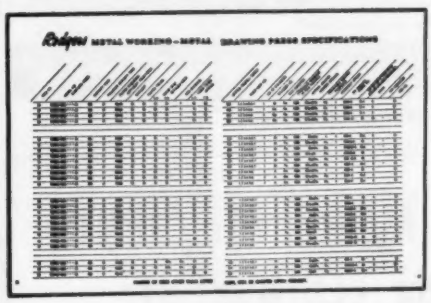
- draw
- other factual data



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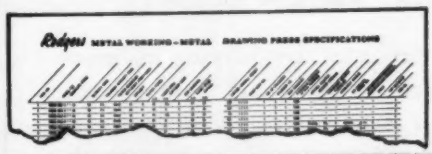

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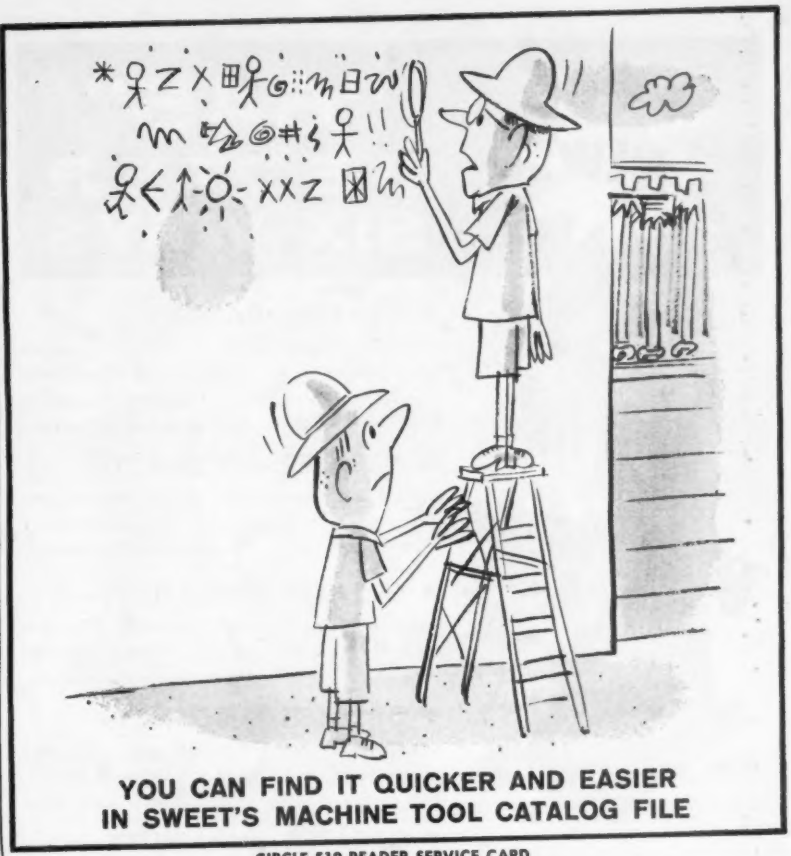

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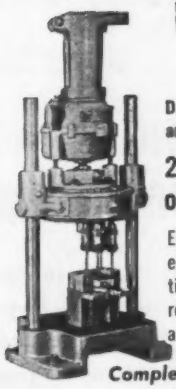

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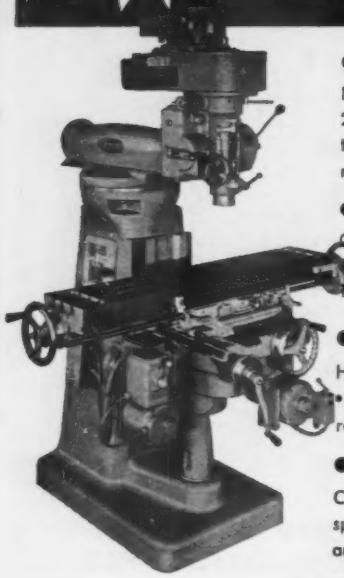

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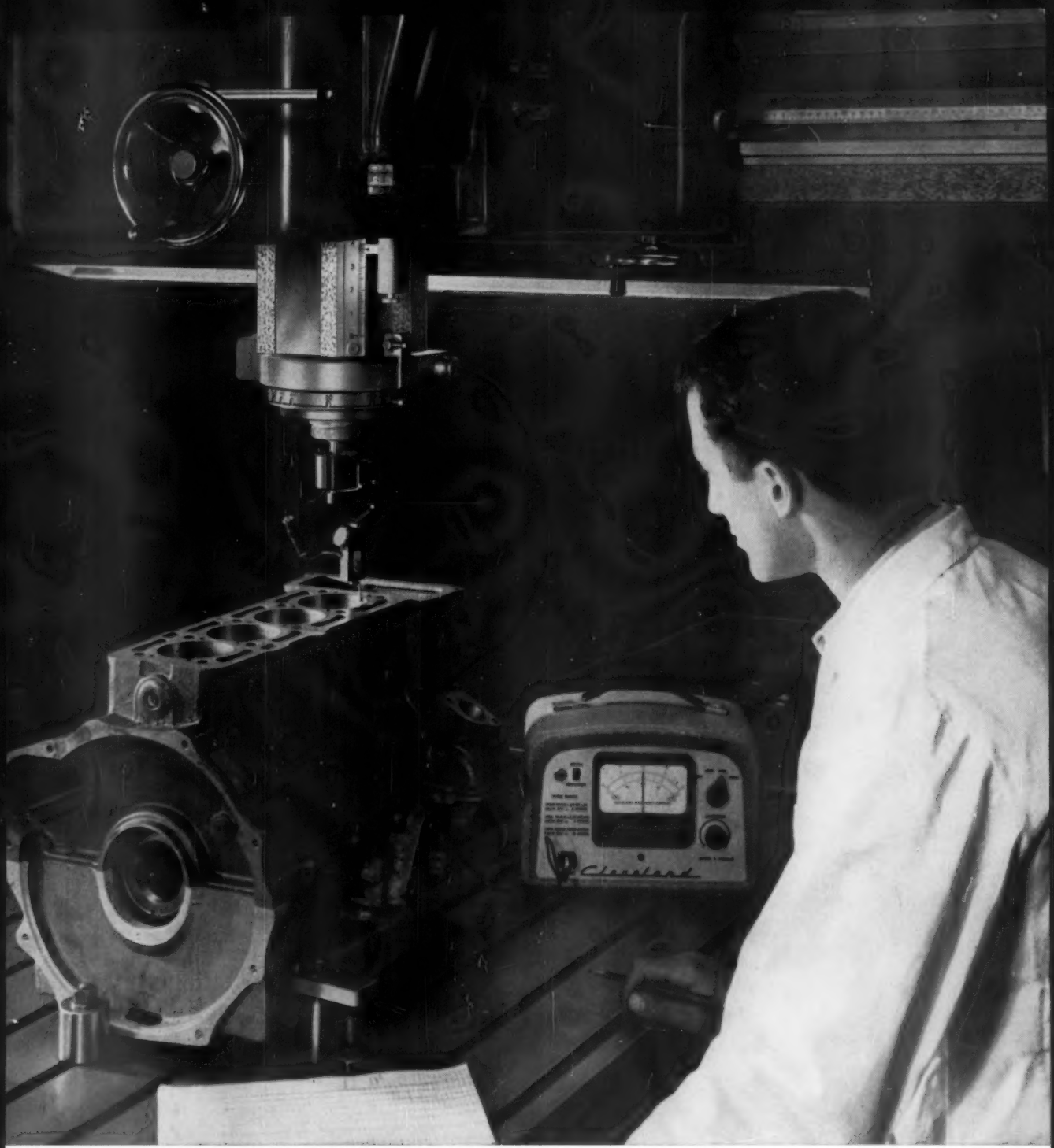

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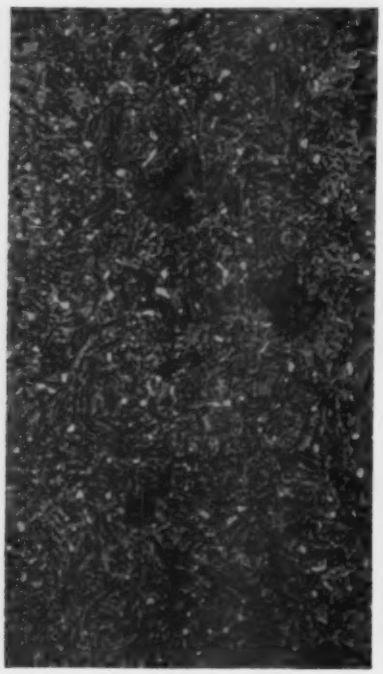

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